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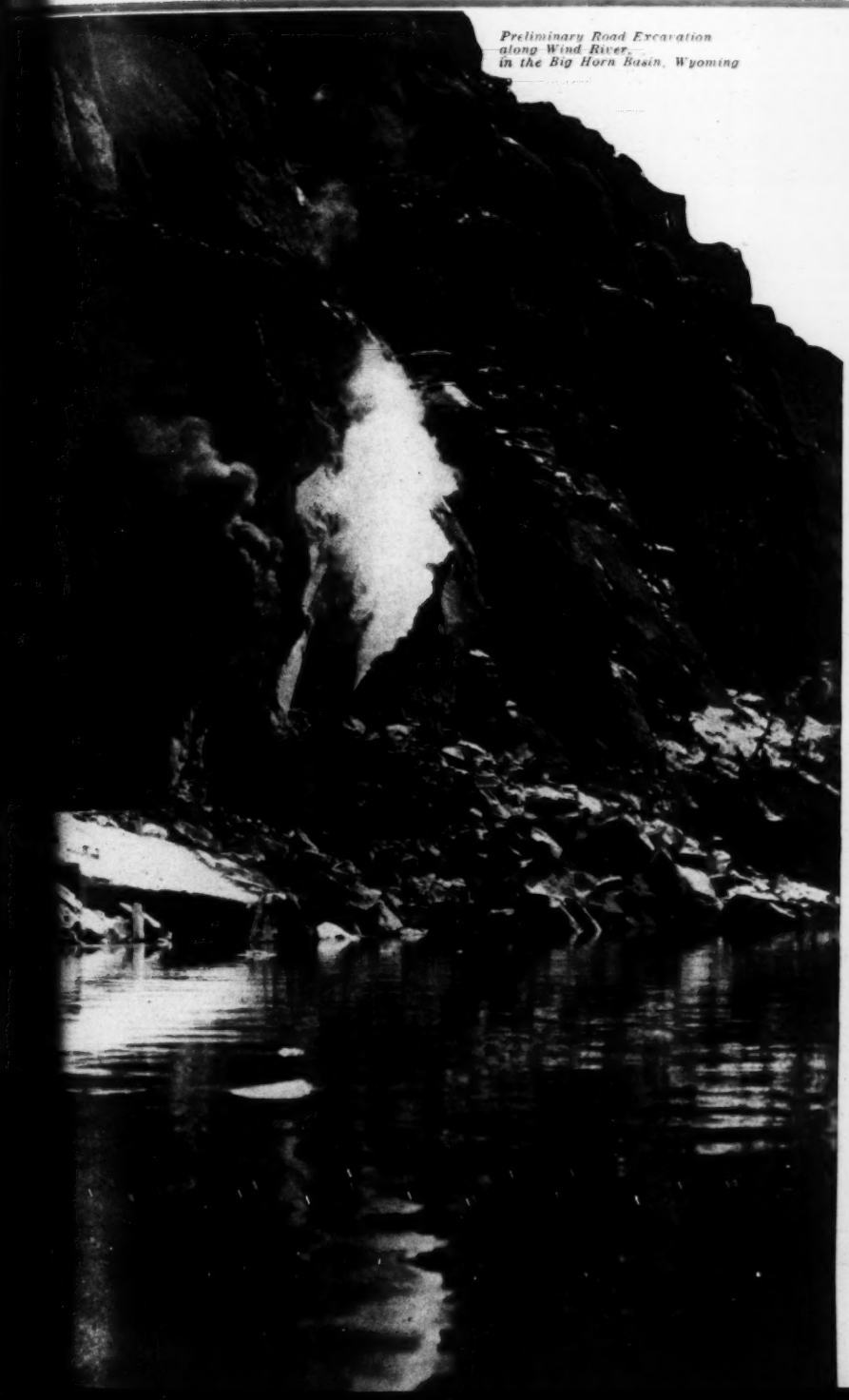
Engineering News-Record



Preliminary Road Excavation along Wind River, in the Big Horn Basin, Wyoming

UPON the engineer's accuracy in estimating unknown items does the contractor's profit depend. What happens when accuracy is lacking is told in

False Statement of Quantities Unbalances Bid

By Clinton L. Bogert

PROBLEMS arising on a highway job wherein grading alone cost approximately $100,000 per mile are discussed in

Construction Methods on a Canyon-Side Road in Wyoming

By R. L. Silver

ONE REASON why concrete structures are expensive is because their erection is not a yearlong process. How to eliminate this costly feature is told in

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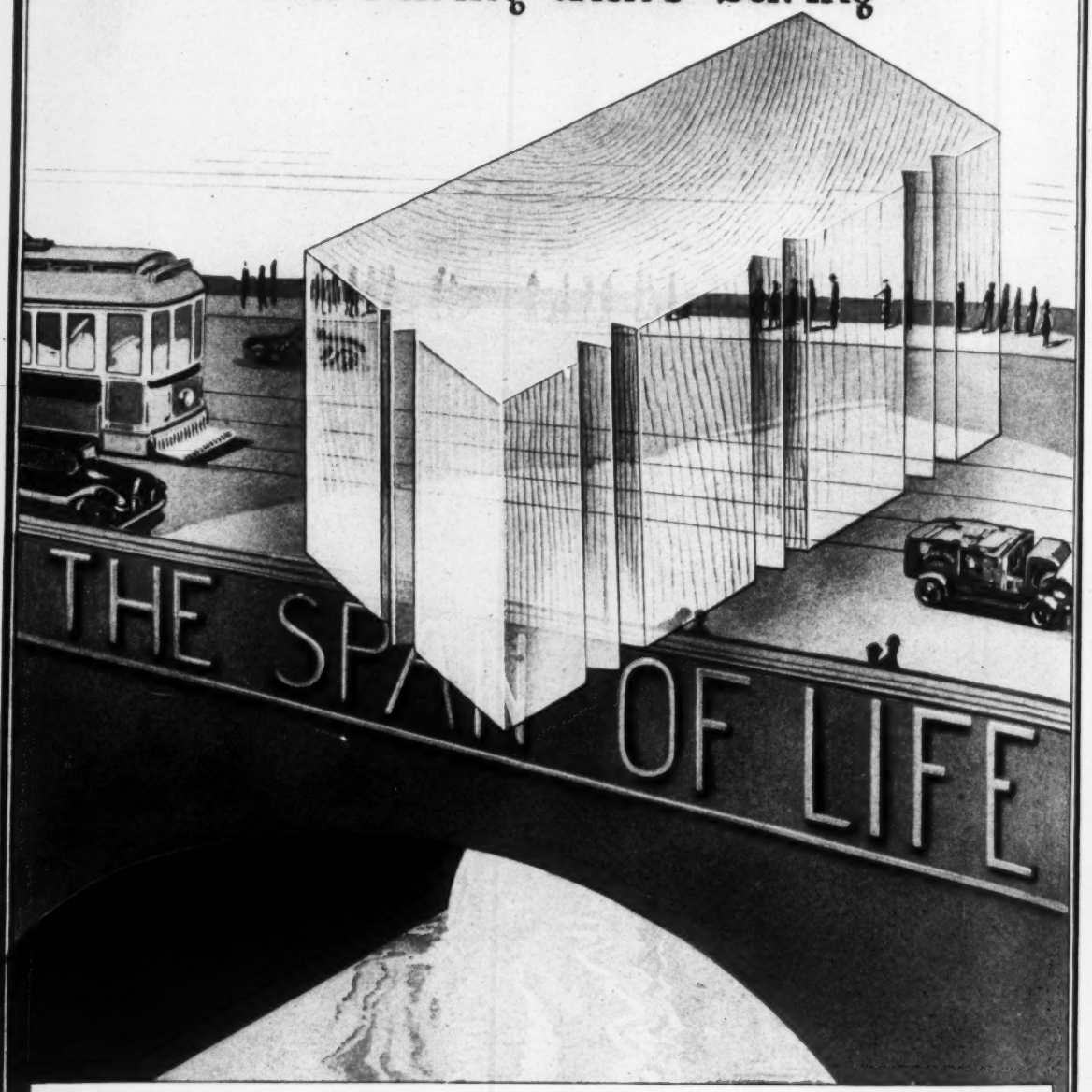

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. Mehren, *Editor*
Frank C. Wight, *Managing Editor*

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Disregarding the Public

IN ITS tone rather than in its content the report of the representatives of the steel industry on the 12-hr. shift is disappointing. Judge Gary and his associates on the committee of the Iron and Steel Institute have yet to learn the art of giving in gracefully. It is hard to believe that they do not know that the public generally regards the 12-hr. day as a social anachronism and that any industry that persists in continuing it under the plea of economic demand must sacrifice much of the good will of which big business today stands in so much need. Sooner or later the steel business will give up the long shift; just now the condition of the labor market and the general drive for production may make the change difficult but the economic as well as the social trend point surely to the shorter day. How much better would the steel manufacturers have stood in the eyes of the critical public had they acknowledged this future certainty and argued then the current difficulties instead of throwing an atmosphere of refusal around a report which does at least grudgingly admit the possibilities of future retreat. They might, too, have let the experts on public relations who in late years have done so much to increase the public's respect for the steel industry advise them before they wrote into their report that masterpiece of tactless phrasing—"Whether or not, in the large majority of cases, 12-hr. men devote less time to their families than the employees working less hours is perhaps questionable."

Mountain Highways

ONE of the most virile passages in the story of American engineering—flinging the great transcontinental railways across the Rocky Mountains—is in a large measure being repeated today in the mountain road-building of Colorado and Wyoming and their sister states of the Far West. The Wind River Canyon highway described in this issue is but one of a score of similar projects and is chiefly significant because it typifies a group of undertakings which are as bold in their expenditures and as difficult in execution as engineering anywhere has attempted. It is of structural practice, however, that it is desired to speak. These mountain highways are not inferior road structures. They are being built almost invariably to grades not exceeding 7 per cent, while eastern states are protesting that in rough country the costs of such grades are prohibitive. They are graded 26 and 30 ft. wide and are ditched and drained in permanent fashion. Costs of $50,000 to $100,000 a mile are freely assumed to produce permanent grade without surfacing. Accomplishments of such nature, in states whose property values and population are less than those of many counties in the East, indicate as sound a conception of the modern highway as any of the paved roads of Pennsylvania or Massachusetts. And these expenditures are being undertaken, not as they are in the East, to accommodate an existing traffic, but to develop a territory and create a traffic. Roads like that through the canyon of the Wind River in Wyoming are constructive enterprises in the largest meaning of the term, for they are creative as well as serviceable.

The Building Congresses

THE Building Congress movement entered a new phase of its development last week when the New Jersey Building Congress was organized. The building congresses now in existence, at New York, Boston, Philadelphia, Portland, and Seattle and the new one organizing at Minneapolis cover their specific localities only. State-wide organization has not been attempted. The reason for the broader movement in New Jersey readily suggests itself. The state is small. The communities of importance are relatively close together and conditions in one city quite quickly effect all the others. Close relationship, therefore, between all of the communities of the state was highly desirable. The enthusiasm with which the original suggestion for a local congress at Newark was expanded into a state-wide conception is evidence of the general appreciation of the inter-dependence within the state. But at its very first meeting, for organization, it was quite apparent that the leaders of the movement understand clearly that its strength must be derived from vigorous local functioning. The first care of the executive committee will undoubtedly be the establishment of subsidiary branches in each important center. The short distances between them will contribute to a vigorous stimulation one by the other. While New Jersey's case, therefore, is a special one, it should quickly give indication of the value of organizing the building congress movement along state as well as along local lines.

From Small Beginnings

THE preceding comment on the New Jersey Building Congress prompts a word of admiration for the steady progress of this movement and for the foresight of its organizers in placing their faith in small and simple beginnings. They believed that if their idea was sound the congresses would grow of their own strength without any elaborate machinery of promotion or complication of constitution or by-laws. The parent body is an extremely loose organization with little or no machinery. It keeps in the background. It does hardly more than interchange information regarding the new activities of the local congresses. The New York Building Congress, the Boston Building Congress, the Seattle Building Congress—these are the bodies in the public eye, these, and not an overspreading national organization, constitute the strength of the movement. Without much blare of trumpets the several local congresses have brought together in an effective way every element of the building industry; we should underline the word *every* for that is an actual accomplishment. Aside from results in the establishment of apprenticeship systems, development of codes, studies of seasonal employment,

etc., there has been engendered in these several cities a confidence of each group in the other. Controversial subjects have been avoided that there those things might be accomplished on which all were agreed. The building industry as a whole is under a debt to Robert D. Kohn and his associates for launching the movement and for vesting it with an appealing simplicity.

Give the Railroads a Chance

EVIDENCE is accumulating that the next Congress is to be the scene of another attack on the railroad problem with the avowed purpose on the part of the so-called "Progressive" bloc of ultimately forcing government ownership. The conference called at Chicago last week by Senator La Follette was only the opening gun. Such of the proceedings of that conference as the public was permitted to hear indicated a drive against the Transportation Act with special animus against the fixing of rates by the I. C. C. valuation, which according to all the speakers is pointing toward an unreasonable excess over what they are pleased to call investment cost. If the valuation which these men think reasonable were established the railroads of the country could not survive and the government would have to assume ownership. Fortunately those who believe that this would be a calamity realize the situation and are preparing to meet it. The study under way by the Chamber of Commerce of the United States will be available before Congress meets. The facts there gathered, backed by the sound business men of the country, should have a salutary influence in persuading Congress to let the railroad situation alone for sufficient time to demonstrate whether or not the Transportation Act will work. The past five years have been so unsettled in the railroad business that no useful deduction can be made from what has happened. The railroad managers should be permitted to carry on under some sort of stable conditions for long enough to show what they can do when given a fair chance.

Road Location by Legislature

ONLY commendation is deserved by Governor Smith of New York for his defense last week of technical direction of state highway development. In vetoing a bill which had taken a consistent state system map prepared by the engineers of the highway commission and transformed it into an engineering absurdity of dead ends, missing links and parallel roads he announced: "The laying out and construction of roads is an administrative duty. We have a corps of competent engineers who have been in the employ of the state for a great many years, and if the legislature would leave them alone these engineers would give us a connected and a comprehensive state highway system that would be designed to meet the needs of the greatest number of our people; but as long as politics and legislative tinkering continue to dictate by a law to the highway department, we must expect the same chaos and disorder that grew out of the performance of this year's legislature." Highway location by legislature has no justification in engineering thought and seldom commands the respect of even its own political supporters. New York State does not stand alone as an example of its extravagance and inconsistency, and in speaking out frankly for engineering direction in his state, Governor Smith has strengthened the hands of state highway department engineers all over the country.

Reproduction Cost New Affirmed

IN THE Missouri telephone rate case just decided by the United States Supreme Court the significance, curiously enough, lies in the minority opinion by Justices Brandeis and Holmes, rather than in the majority ruling. The decision itself, though it reversed both the Public Service Commission and the courts of Missouri, is in accordance with the long established rule of the Supreme Court that for rate making purposes the present value of a public utility must be used and that value is best established by determining the reproduction cost new less depreciation. The public service commission undertook to fix 1919 value on the basis of 1913-14 costs and the Supreme Court ruled that in view of the rising scale of prices in that period rates so fixed are confiscatory and therefore unconstitutional. The dissenting justices agree that the fixed rates were too low and therefore concur in the reversal but argue against the reproduction cost new theory of establishing value and suggest the prudent investment basis.

The law, as interpreted by the highest court, has not, therefore, been changed. Regardless of the fact that more and more frequently public service commissions have been seeking to establish some other basis of value than reproduction cost at present prices, that method is accepted with practically no argument or explanation by the Supreme Court. The court does not, to be sure, accept such a value except for rate-making purposes, as is indicated by the fact that it sets the proper value of the telephone properties involved at around $25,000,000 as against the $20,400,000 of the commission's production cost and the $31,000,000 of the company's reproduction cost less depreciation, deducting therefrom the $5,500,000 cost of establishing the business. What it does do is to state that present prices must have large if not governing consideration in establishing present value, which it continues to maintain is the proper basis for rates.

Justice Brandeis, on the other hand, points out the numerous difficulties in such a plan. The most important of these is the obvious necessity, in these days of rapidly and materially changing unit prices, of revaluing at frequent intervals, for if the company is entitled to profits on the unearned increment in its property, the public is likewise entitled to the decrement which follows a dropping price scale. The economic trend of the past five years has forced recognition of this principle. When prices were fairly stable, or at least rising on a gradual slope, established values were good for long periods. Since the war, however, the difference between profiteering reward and bankruptcy may well lie in the exact date of fixing value, if reproduction cost is used as the basis for such value. And it may well happen in some particular case that the company is just as opposed to such a method as the Missouri telephone company favored it.

The other major point that the minority opinion makes is that it is becoming increasingly easier to determine actual prudent investment. With the growing requirements for public utility publication of accounts and the necessity such utilities are under of keeping their books in accordance with rules true value is more nearly a matter of record than in the past when the details of such a business were not discoverable. The difficulty of determining just how much money had really been invested was possibly the principal reason why the reproduction method was adopted. In many

valuations that reason is still controlling. In fact, the easy avoidance of that difficulty by the so-called LaFollette conference at Chicago last week (p. 1016) does more than anything else to discredit the intentions of that body. As time goes on, however, the public utility business will become better defined as to investment and the determination of the "fair value" laid down in the legal rule become more nearly a matter of study of records than of opinion, as it is today.

Companies engaged in public utilities are entitled to a fair return on their investment, having due regard both to the privilege the public extends to them in letting them do a public business and to the necessity for encouraging capital to embark in such enterprises. Many methods for fixing that fair return have been advocated—and practically all have been applied in some cases—but the trend of the law, which in spite of theory must be governing, has been toward a full recognition of the reproduction cost new as the most equitable basis of establishing value. It is, however, only a basis and not the universal and simple solvent. With the increase in public utilities and with the increasing desire of the public to supervise their operations the problem will become simplified because more of the facts needed to establish value will be available.

Road Work and Construction Congestion

ROAD building is the greatest construction task of the United States. A billion dollars, it is estimated, represents the work which may be undertaken this year. With the claimed deficiency in construction capacity to meet construction needs, which is developing, the suggestion is being made in some quarters that immediate highway improvements should be postponed. Admitting the emergency this thought is wholly natural and logical.

If restraint in construction is desirable, as appears to have been generally concluded, then highway builders should exercise it in conjunction with other builders. It is just as apparent, however, that drastic curtailment of highway improvement programs should not be undertaken until it is clear how far it will release contractors, materials and workmen of which there is a deficiency in the general construction market. Indeed it may be written down as a certainty that federal and state highway officials will not approve reduced construction program until they have more evidence than their observation provides that general curtailment of road building operations will greatly affect the shortage which it is asserted exists in the means for other construction activities.

Except in paved road work few of the agencies demanded in industrial and municipal construction are being extensively employed in road building. Barely 25 per cent of the money being expended in road improvement is for paved roads. Three-quarters of the work being done is permanent grading and drainage and surfacing with gravel or other special soils obtained locally. The contractors employed confine their operations largely to earthmoving and do not go far abroad for work. The same is true of their help. Commercially-produced materials are but little used and transportation is a local haulage operation employing trucks and trains. It is not possible to draft any significant volume of these construction forces into the field of building or general engineering construction.

There is now no general lack of contractors and labor for road work except possibly in paved road construction. In pavement construction only is the materials supply a matter of concern. Plenty of bidders are being had for grading and gravel surfacing. Observations made in a survey of road development in ten states indicate that for grading and surfacing competition is active and prices are reasonable. A less favorable situation exists in respect to paving. Here there is developing a lack of bidders and prices are rising. Curtailment is already being and will continue to be undertaken as costs mount to a level where it is economy to delay paving contracts and turn money and effort in other directions.

There should not be nor will there be by public roads officials any holding back in an effort which, like the present campaign to prevent an excessive demand on construction agencies, tends to stabilize construction. To go about the reduction of road construction in any wholesale way is, however, not effective co-operation in the emergency which it is considered exists.

Rudolph Hering

WITH the passing of Rudolph Hering America loses her long-time dean of the sanitary engineers. Eminent as Dr. Hering was in his profession, and as much as he contributed to its technical advancement, he will always stand still higher as a friend. That capacity for friendship and a helpfulness to all, especially to young men, were notable traits of his character. This was well expressed in an address on Dr. Hering's professional career, made at his funeral by George W. Fuller, his one-time partner, when he said: "My first impression of Dr. Hering was that of his unusual interest in helping young men, particularly young engineers. Men from various parts of this country and abroad have repeatedly spoken to me of this very lovable trait of his. I am sure that he was a powerful inspiration of many a young engineer."

Dr. Hering's contributions to sound engineering theory and practice are so well known that to enumerate them here is unnecessary. Attention may be called to the summary of his career printed elsewhere in this issue; to a review of his work up to that time in *Engineering Record*, Aug. 15, 1903, p. 195 (unsigned, but by John M. Goodell) and to a longer appreciation, by Charles Whiting Baker in *Engineering News-Record*, Aug. 6, 1918, p. 274.

Professionally, Dr. Hering's most notable characteristics were engineering scholarship, practical judgment and its application, a tireless interest in advances in theory and practice, and a never-waning enthusiasm to pass on the torch of sanitary engineering progress. He kept ever in touch with his profession, both by attending technical society meetings and by visiting sanitary engineering works showing marks of progress. This was particularly true as regards achievements abroad, as was so well put by Mr. Fuller: "He had an unusual gift of learning what was new in European practice and in bringing the principles back to this country and stating them in a way that their usefulness might be available to his co-workers in America. In my opinion he was foremost of the American engineers to teach his associates on this side of the ocean how to be wisely guided by developments abroad."

A scholar, a leader of thought and practice, a friend, has passed on, but there remain his work as a monument and his rare personality as an inspiration.

Construction Methods on a Canyon-Side Road in Wyoming

Side Hill Cuts in Solid and Loose Rock Slopes Involved Coyote-Hole Blasting, Tunneling Granite and Diorite and Blasting Talus for Steam Shovels

By R. L. Silver
District Engineer, Wyoming State Highway Department, Basin, Wyo.

HIGHWAY construction involving expenditures for grading as large as $97,000 a mile is worthy of note anywhere. In a state covering 100,000 square miles, with a total population of 200,000 and taxable property less than in many counties in eastern states, the undertaking becomes remarkable. Wyoming now has such an operation under way near Thermopolis, through the lower canyon of the Wind River. The project moreover is strikingly characteristic of modern highway development in the mountain country of the West: (1) A comparatively short road opens up a vast and naturally rich territory previously isolated in a great measure; (2) physical standards, as grades, curves, width and alignment, are not excelled in any section of the country; (3) construction methods typify modern practices in rock-cliff and talus-slope cuts and fills and large-section tunneling.

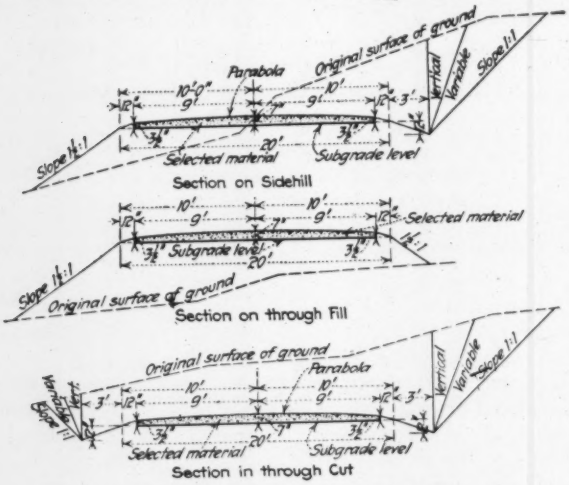


FIG. 1—SECTIONS OF ROADWAY ON SOLID-ROCK AND TALUS SLOPES
All curves are superelevated, 0.04 per foot for 6 to 12 deg. and 0.06 per foot for curves sharper than 12 deg.

Isolated Territory Opened Up—The Big Horn Basin is located in the northwestern part of Wyoming and includes the 228,000-acre Shoshone Project of the U. S. Reclamation Service, in addition to many Carey Act and private projects under cultivation. Oil fields, with a refinery, extensive coal mines, and an apparently inexhaustible supply of natural gas exist. Topographically this basin, so richly endowed in natural resources and possessing such extensive agricultural possibilities, is separated from the rest of the state, being bounded on the east, west and south by high and rugged mountain ranges and on the north by the state of Montana. The mountains make an unsurmountable barrier to highway transportation except during a short summer season when light automobile traffic is possible. From the southern boundary of the basin the Big Horn River enters through a narrow box canyon known as the Wind River Canyon. This is the only possible low-grade route for a highway which will eliminate the objectionable and dangerous link over the mountains.

Locating the Line—A preliminary survey was made early in 1921 and the data obtained from this survey were used in working out the details of the financing of the project. A location survey was made early in 1922, upon which the Federal Aid plans were prepared and a contract let June 1, 1922. The project was approved by the officials of the Bureau of Public Roads upon the regular basis of Federal Aid in Wyoming, which is 64.65 per cent to be paid from Federal funds.

For the preliminary survey the organization comprised a party chief, a transit man, two chainmen, a stakeman, a levelman, a topographer, two rodmen, a cook and an axeman. The organization of the location party was the same except that the topographer was omitted.

Both the preliminary and location surveys were made during severe winter weather when the mercury would average 10 to 12 degrees below for long periods, and access to the work was made possible by the river being frozen over at most points. This survey consisted of 28 miles of line from Bonneville to the northern end of the project and the two surveys cost $7,405.49. On the preliminary survey a base line was run, from which accurate topography was taken, and an estimate was prepared from a paper location. The second survey could be considered as a second preliminary, although all curves were staked and sufficient cross-sections for the preparation of an estimate were taken. However, in order to improve the line and fit it more closely to the topography, the major portion was relocated by the construction parties and a revised estimate was prepared. Location parties camped at Boysen, Dornick and Thermopolis, and all supplies were shipped in by rail.

On this project the grades are a minor consideration as the general route follows the river, and what grades were used were for the purpose of avoiding difficult points of construction. On the talus Section C where danger from slides was evident the line was placed as near the edge of the cliff or top of the talus as practicable in order to avoid as much slide material as possible. In many cases where slides might be encountered at a lower elevation the upper slope reaches the rock cliff making any major slides at these points impossible.

In the mountains where grade development is necessary it has always been possible to adhere to a 7 per cent maximum by the expenditure of sufficient money. The Bureau of Public Roads has generally demanded a 7 per cent maximum or less, and the state department has followed the principle that where a project is worth constructing it is worth the expenditure of sufficient funds to obtain at least a 7 per cent maximum grade. In the present instance the final location is on a 5.6 per cent maximum grade, maximum curvature of 200-ft. radius, and 20-ft. roadbed with 3-ft. ditch in cuts as indicated by Fig 1.

Physical Features—Due to the marked division of the nature of the material encountered the project was

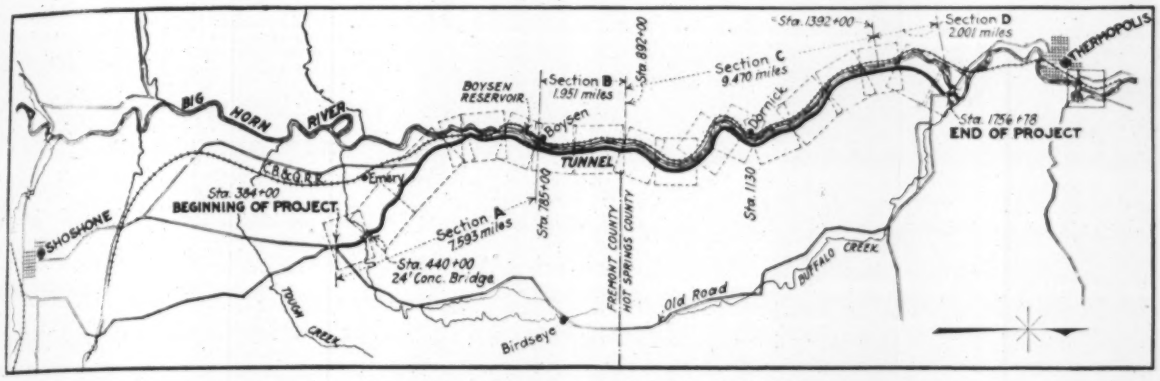


FIG. 2—LOCATION MAP, WIND RIVER CANYON ROAD

divided into four construction sections, Fig. 2. Section A extends from the south end of the project to the end of the canyon, a distance of 7.59 miles. The estimated cost is $106,000. The material is varied and the contract was let upon specifications having the three general classifications.

Section B, from Station 789 to 892, extends through the box canyon where the material is 100 per cent solid rock, consisting of a very hard black diorite and a hard red granite. The length of this section is 1.95 miles and the estimated cost is $189,238 exclusive of surfacing and guard rail. The estimate on this section includes 84,000 cu.yd. of unclassified material, and three tunnels having a total length of 842 ft. The tunnels are through black diorite and are constructed 18 ft. wide and 14 ft. high.

Section C is 9.4 miles long. The material is principally a sandstone and limestone talus covering many massive boulders, with several short stretches of vertical cliffs. There are 302,600 cu.yd. of unclassified material on this section and the estimated cost is $233,600, exclusive of guard rail and surfacing.

Section D covers 2 miles at the lower end of the canyon, where the material is earth and the construction is comparatively light.

Construction Plan—Contracts for Sections B, C and D were let on June 1, 1922, to the Utah Construction Co. of Ogden, Utah. The construction program adopted by the contractor calls for the handling of Section B largely by hand labor, Section C by steam shovels and Section D by team and fresno outfits.

The Denver-Billings line of the Chicago, Burlington & Quincy Ry. runs through the canyon on the opposite side of the river, which materially simplified the problem of getting material and equipment to various points on the work. Opposite Station 792 the Wyoming Power Co. has a plant from which power for camp purposes and the operation of a compressor plant was obtained. The contractor established his headquarters camp at Boysen, near the power plant, and installed a compressor plant at this point. Air was piped from this plant over the full length of Section B, the box canyon section. A number of foot bridges were also constructed across the river.

Open Cut in Rock—Coyote-hole blasting was the characteristic feature of open cut in rock. On the up-hill side the rock stands practically where shot and very little trimming is necessary. Many of the slopes, where seams occurred near the slope line, are standing practically vertical and in very few cases in the hard rock material does the slope exceed ¼ to 1. The spacing and loading of coyote holes, Fig. 3, varied for every shot and depended on the size of the cut, the nature of the material, and the judgment of the foreman in charge. In some cases these holes were loaded heavier than necessary in order to get rid of the material or to obtain extra material for borrow. It has been the intent of the contractor throughout the job to do as little hauling as possible and he has moved considerable extra material in order to avoid haul which in some cases has not appeared to the writer to be the most economical practice. Coyote holes averaged 3½ ft. in diameter and

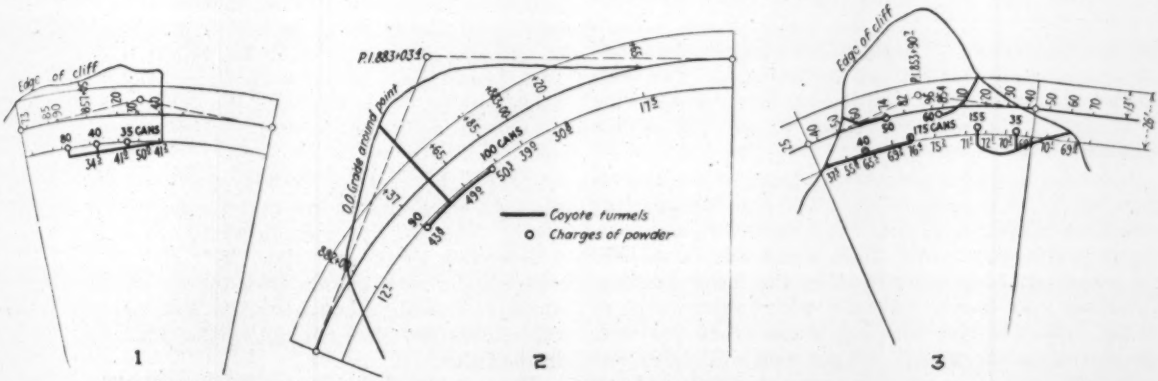


FIG. 3—TYPICAL COYOTE-HOLE BLASTS ON ROCK CUTS

1. This blast moved 3,000 cu.yd. It hit and "broke on" a seam on the upper slope line placing all of the material outside of the section. It broke off the bottom of the cut but placed all material in such a way that 100 cu.yd. will build the fill to full width. 2. There were 4,000 cu.yd. in the cut not over 10 per cent of which fell outside of the section. 3. Of the 6,000 cu.yd. in this cut, 65 per cent was thrown out of the section and most of it to the fill section adjacent.

were usually flat on the bottom and had a circular arch top. The loads were placed about 1 ft. below grade, and the cut generally broke a little below grade. The heaviest charges were placed on the upper cut ditch line, as shown in the diagrams.

No appreciable amount of material has been thrown upon the track, although some of the shots have caused some damage to a few rail lengths. The railroad company was notified before shooting the heavier charges, and had a gang of men nearby to repair any damages. Indeed the railroad company has co-operated with this department wherever possible and has been of great assistance to the contractor in giving him sufficient unloading points for supplies and equipment. The shots at Stations 857 and 884 were at a safe distance from the track. It will be noted that the load at Station 854 was so placed as to tend to throw material parallel to the line instead of across the river. The variation in amount of loading of these charges was due to the intent of the contractor either to waste or save the material. In loading coyote holes all powder was emptied from the cans and covered with 1 ft. of loose material. The primer consisted of two sticks of dynamite and a cap; two primers in each charge, the extra primer being placed for emergency. All were shot by battery. The ends of coyote holes were plugged with the material at

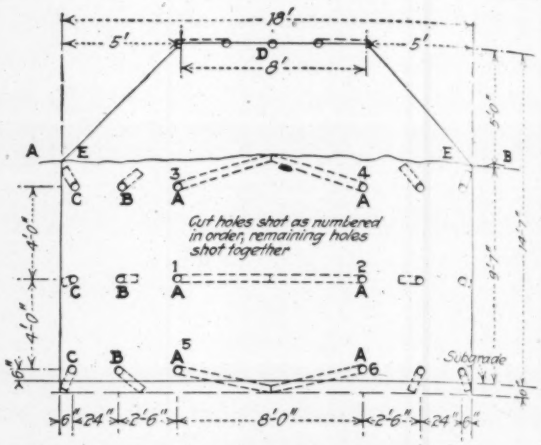


FIG. 4—DRILLING DIAGRAM FOR HARD ROCK TUNNEL

Loading: Lower heading 75 lb. to 150 lb. dynamite—80 per cent of which consisted of 80 per cent strength and 20 per cent of 60 per cent strength. Average break 6 ft. Upper or Arch Section 35 lb. to 40 lb. dynamite, 30 per cent of which consisted of 80 per cent strength and 70 per cent of 60 per cent strength; average break 10 ft.

Drill Holes: A, cut holes 9 ft. deep meet at center as shown; B, 7½ in. deep, tilt toward center 1 ft. and bottom and top holes tilt down and up 1 ft. as shown; C, 7½ in deep tilt out 6 in. and at bottom and top holes tilt down and up 1 ft.; D, three holes for arch starting 2 ft. c. to c. and ending 4 ft. c. to c., 10 ft. to 11 ft. long and following grade of roof; E, short plug holes after arch shot.

Schedule: Heading blasted first and then arch section.

FIG. 5—BOX CANYON TERRAIN BEFORE CONSTRUCTION

Temporary bridges at intervals from the railroad track side were the only means of access to the road location. At point of view classification was 100 per cent solid rock.

hand. The breakage of all was near to grade but where it was necessary to move the material considerable block holing was necessary. Hexagon ¾-in. jackhammer steel was used for all open cut and coyote work. The overbreak was small except where the contractor was loading with excessive charges in order to get rid of the material.

Tunneling Methods—A section of one of the tunnels showing the arrangement of holes and the blasting schedule is shown in Fig. 4. This represents the average condition, but where the material was extra hard six additional holes were used in the lower heading. Cut holes were loaded generally with twelve sticks of 80 per cent, the rest with six sticks of 80 per cent, completing the charge with 60 per cent. All firing was done with fuse. The cut holes were shot first and any remaining hole was reloaded and shot with the rest of the charge. Holes five and six were shot after one, two, three, and four, permitting the material to rise and avoiding the throwing of much material in front of holes C and B. The material in tunnels broke small enough to handle by hand mucking and required little block holing.

The steel used in tunnel drilling was Ludnum hollow round 1¼ in. in diameter. The drills were Waughturbros and Ingersoll-Rand water liners and the sentiment of the drillers favoring each of these machines was about even. As many as four machines on two columns were worked in the heading face but generally two machines on separate columns were used. Drilling was principally done at night and mucking in daytime. The drills were sharpened by machine and experiments were carried on for about six weeks before the proper temper was obtained.

Open Cut in Talus—Section C is nearly all talus slope. From Station 892 to 1,232 the material is a limestone talus for about 80 per cent of the total yardage, with 20 per cent limestone boulders averaging from 20 to 40 cu.yd. in size. These boulders contained a large percentage of calcite crystals, making them difficult to drill. Practically all of Section C was loosened ahead of the shovels by vertical holes, on 20 ft. centers, to 1 ft. below grade loaded with from 125 to 250 lb. of black powder. The delays to the shovels were caused by uncovering buried boulders, which were block-holed and shot with 40 to 60 per cent dynamite. From Station 1232 to 1392 similar conditions and similar methods were used except that the material was sandstone. The cut slopes on Section C range from ½ to 1 depending on the material. With several exceptions, where slides were encountered, the slopes are standing about as staked, although considerable maintenance on cut ditches and slopes is anticipated for several years in the futur

Three types of shovels are being used; type B has a ¾-cu.yd. dipper, the 40 R a 1¼-cu.yd. dipper and the 70 C a 1½-cu.yd. dipper. The dippers all have teeth and frequent renewals are necessary The shovels over-

cast practically all material. In some of the heavier cuts the material has been wasted above grade. It is intended to use the Type B shovel for cleaning up these places, and this material will be loaded in wagons and used where hauling is necessary. The 70 C and 40 R have been making full width at one cut. The Type B has been making full width in two cuts except in the lighter work where full width is made in one cut. This shovel is also loading wagons where hauling is necessary.

The average heavy cutting was 30 to 50 ft. except where slides were encountered. At the vertical cliffs at Stations 1225 and 1295 the maximum cuts are as high as 100 ft. These cliffs have not as yet been shot.

The average monthly yardage, as of April 15, for the 70 C has been approximately 10,000 cu.yd.; for the 40 R, 6,000 cu.yd.; and for the Type B 3,500 cu.yd. These, however, are pay quantities and the actual quantities moved are somewhat in excess of this due to contractor overcasting in practically all cases rather than haul. Our specifications are on a pay-one-way basis, but the contractor on this job has been permitted to waste and borrow at his own expense at points where such practice is not detrimental to the line.

Due to the uncertainty of coal supply during the coal strike all shovels were equipped for fuel oil at the start of the job. During the winter the temperature made fuel oil difficult to handle, and as a coal supply was again certain, the shovels were converted back to coal burners. Fuel has been shipped by rail to points opposite Stations 892 and 1,130 where pile bridges were constructed across the river and hauled by teams from these points. Both of these bridges were lost in ice jams on March 29 and since that time all supplies have been ferried across the river at these points. The water supply has been obtained by portable pumps direct from the river to the shovels. All powder was taken across the river on cableways.

FIG. 6—EXCAVATION OF TALUS INTO RIVER BY STEAM SHOVEL

In section C the material was principally sandstone and limestone talus with massive boulders and several vertical cliffs.

FIG. 7—STEAM SHOVEL FORDS RIVER BY OWN POWER

Management—The work has been handled under the general supervision of Z. E. Sevison, state highway engineer, and the writer as district engineer. The final surveys and field supervision of the work have been under the direction of N. T. Olson, resident engineer. Frank Burek has been in charge for the Utah Construction Co.

Burden of Taxes on British Local Railways

The people of Great Britain in their efforts to reduce railroad rates have discovered that the principal cause of the high rate is due to the local burden of taxes which the railways are called upon to bear. At the present time, notwithstanding reduced assessments, the railway companies are still paying over £8,000,000 a year in the form of local rates, an amount almost double the rate before the war. The ratable value of the railways is represented by net receipts less interest and trade profits. The calculation of local rates on the basis of receipts is made separately for the section of line in each parish, and as a large railway may pass through from 2,000 to 3,000 parishes, the effect is that the sum of parochial assessments is larger than if the undertaking were assessed as a whole. Examination of these local taxes shows that in almost every case the railroads are paying over 80 per cent of the total amount levied. The bulk of these taxes goes to the maintenance of local roads which are handling even more traffic in competition with the railways in England than they are in this country. One parish even maintains a tramway parallel to the railway and as this tramway is run at a loss the railway taxes help to keep it in existence. The estimated cost of maintaining British highways today is, in round figures, £50,000,000 a year, to which owners of motor vehicles contribute between £11,000,000 and £12,000,000, while the railway companies are taxed to the extent of £8,000,000, and are denied the extended use of the highways for purposes of motor transport.

Why One Engineers' Registration Law Was Not Enacted

Some Comments on License Laws in General and on the Proposed Law in Ohio in Particular

By Arthur Richards

City Engineer, Chillicothe, Ohio, and Secretary of the Associated Engineering Societies in Ohio Favoring Registration

IN OHIO, during the session of the General Assembly just ended, an effort was made to pass a registration bill for engineers and land surveyors. The main provision of the bill was: "That in order to safeguard life, health and property, any person practicing or offering to practice the profession of engineering in connection with the design or construction of any public works of the state or any of the political subdivisions thereof, or of land surveying within the meaning of this act shall hereafter be required to submit evidence that he is qualified so to practice. . ." The bill passed in the Senate by a vote of 24 to 1, but was defeated in the House by a vote of 52 to 41.

An examination of the bill will show that it applies only to engineers engaged on work for which public funds are expended and the proponents of the bill were of the idea that this would be the most direct method whereby the engineering profession could act for the good of the public. It is evident to those familiar with public improvements that at least 85 per cent of the engineers required to be registered under this bill would belong to the civil engineering branch, while the remainder would consist chiefly of mechanical and electrical engineers.

While those in favor of registration are actuated primarily in the interest of the public welfare the fact remains that some good is also expected to accrue to the profession and its members. To expect or desire otherwise would be foolish. I have been directing affairs in Ohio in favor of registration for the past six months and in all that time neither by spoken word nor by letter have I known any engineer or person to state he favored registration for purely selfish motives.

The defeat of the bill in Ohio this year can be attributed directly to the opposition of engineers themselves, as the result of the vote taken by the House plainly shows that in the cities where there was active opposition by the local engineers' club the majority of the representatives voted against the bill.

Reason for Opposition—I have pondered considerably as to why any engineer in Ohio should or would want to oppose the bill as introduced. It is significant that those actively opposed did not advance any arguments, to the best of my knowledge, claiming that the passage of the bill would be detrimental to the interests of the public, the state or the profession or to the interests of the engineers and land surveyors in the state who could qualify to become registered.

It will be conceded no doubt by every one that the great majority of persons in the following groups would oppose registration: (1), Incompetent persons practicing engineering; (2), engineers who place money first, ethics second; (3), engineers not directly affected by the bill and who take little interest in civic affairs; (4), corporations securing work of a public nature by submitting their own plans and designs; (5), various self-styled engineers; (6), inexperienced self-made land surveyors.

Of these six groups the third is the only one which could exert a strong influence on the legislators as the group is composed of engineers who are fully qualified to become registered if they so desire.

A ballot taken by the Engineers' Club of Cincinnati among the members of the following societies in Ohio shows very plainly that engineers not affected by the bill and not engaged on public works are very much opposed to registration:

	Per Cent
In favor—A. S. C. E.	54
Opposed—A. S. M. E.	84
Opposed—A. I. E. E.	83
Opposed—A. I. Ch. E.	80

The members voting in the above ballot, however, did not receive a copy of the bill for consideration which may account for the large percentage of opposition.

When a ballot was taken by an engineering society in Ohio where every member received a copy of the bill and no intimation was given as to which way you desired the members to vote an entirely different result was secured, as shown below:

	Per cent in favor
Akron Engineers' Club and affiliations	58
Columbus Engineers' Club and affiliations	84
Ohio Engineering Society	93
N. W. County Surveyors' Association of Ohio	95
American Association of Engineers in Ohio	94

In no case where a society received copies of the bill did a ballot show a majority opposed to the bill.

I know a great many good engineers in Ohio fully qualified to become registered who were opposed to the bill. They presented various arguments but none stated that the bill would be detrimental to the interests of the public, the profession or the engineer. One stock argument was: "That the bill is not demanded by the public." Those familiar with government legislation know that very, very few bills for the public good are initiated, demanded and fought for by the public. Legislation for the public good is invariably presented and advocated by specialists in some line of endeavor and the engineers' registration bill is no exception to the rule.

Some engineers were opposed to the bill because the requirements were too strong, while others thought they were not strong enough. Some of the legislators voted against the bill because they felt they had no engineers in their county who could qualify to become registered and therefore they would have no one competent to run for the office of county surveyor or to perform their other public engineering work. This thought was stated to me personally by three different representatives, and it is a fact that in three counties of Ohio the county surveyors or engineers are respectively a blacksmith, a clerk, and a farmer.

It was brought out that a great many of the older engineers are very indifferent as to registration while the younger engineers are invariably in favor of it. The members of the American Association of Engineers in Ohio, having an average age of thirty, and about 1,200 in number, voted 94 per cent in favor of registration, practically all of the members being fully qualified to become registered. Students at engineering colleges who had an opportunity to study the provisions of the bill were generally in favor of such legislation

and a ballot taken at one college showed a 100 per cent favorable vote.

In *Engineering News-Record*, April 19, 1923, is an editorial treating on various non-technically trained persons who call themselves "engineers." In the same issue is an article on "Some Engineers I Have Known" which plainly shows just where the title "engineer" is going—most anywhere. The editorial states: "The fact remains that the title is the necessary designation of a large class of men engaged in responsible, difficult, professional work, and they can not long countenance its flagrant misuse, whether within or without the profession," and still *Engineering News-Record* will not advocate the one sure plan of protecting the title, which is by registration.

The section in the defeated Ohio bill which defines professional engineering contains the following: ". . . and who represents himself to be such an engineer, either through the use of the term engineer with or without qualifying adjectives, or through the use of some other title implying that he is such an engineer." It is considered that this section would preclude any one's using the title "engineer" in any manner, unless exempted because of present statutes, and it would seem this would be the shortest and surest way to accomplish the purpose desired.

Misuse of "Engineer"—The editorial further states: "Abuse on the part of non-professional men must be fought by engineers themselves, through group opposition." Experience has shown in other professions that the only way to stop such abuse is by legal methods and the only legal method available in this case is registration. The general promiscuous use of the title "engineer" has developed very rapidly in the last few years and in my opinion has been due to two causes. One is the prominence the engineer received during and just after the World War, and the other is the fact that the engineer finally is being recognized by the public as a person of high accomplishments. The pseudo-engineer appreciates the full value of the title "engineer" and knows it is a sure means by which he can gain the confidence of his victims, and the people in general having a high regard for the title take the pretender at his word. You can not combat the pretender with soft words or by explaining the ethics of the profession, because he is out for business and the title "engineer" is the "good will" which he covets.

The strictly professional engineer a great many times uses his technical brain to the exclusion of his common sense one. He is apt to think he is in a class by himself, that he is above doing business things like other common mortals and that he should be always the instigator rather than the follower. A lesson in how to do things for the good of the public and incidentally for the good of himself may be learned from the "stationary engineer" who is not technically trained, is not highly educated and has learned his trade mainly by practical experience.

For over twenty years in Ohio there has been a law which provides that no person shall operate a stationary steam boiler and engine of more than thirty horsepower, except boilers and engines under the jurisdiction of the United States and locomotive boilers and engines, without obtaining an engineer's license. I inquired in particular as to why such a law was passed and was informed it was enacted for the public good, and those familiar with the subject know the statement to be true. Most engineers also know that the basis of boiler construction and inspection in many states is the A. S. M. E. boiler code, which fact demonstrates that there can be close co-operation between the professional engineering societies and the public.

The Ohio registration bill as introduced was intended to perform a duty in regard to public works just as the "stationary engineer's" bill performs a duty in safeguarding the lives of people, and there is no reason why in time there should not be an Am. Soc. C. E. code to cover the general design and construction of public improvements so the people would be assured of safe and economical improvements.

The Ohio bill, as mentioned, sought to have registered only those engineers engaged on public works and it is obvious that this method would assure the most direct benefits to the people at large. As to whether we should have a general compulsory registration law for all engineers is an entirely different problem as an analysis will show that such registration would be primarily for the interest of the profession and its members, the public consideration being of secondary importance inasmuch as the great majority of engineers are not engaged on public works. Optional registration can not accomplish very much unless most of the engineers register, and because there are so many engineers who care nothing about the status of the profession, who do not belong to any local or national engineering societies, who do not subscribe for current engineering literature and who take no part in civic affairs, then it follows that few will register of their own accord.

The movement for registration, as I see it, is simply a movement of those engineers who have a vision of good for the public and the profession, which vision some engineers will not see until they are forced to look.

The personal success of the engineer depends upon the concerted efforts of all engineers and the best way to success is to get behind a just registration bill and have it enacted into a law.

Reading Railroad Is Carrying Out Extensive Improvements

Various improvements aggregating expenditures of about $12,084,500 are planned for this year's work on the Philadelphia & Reading R.R., as summarized below. Much of the work is under contract and in progress, but plans are being prepared for the Port Richmond grain elevator, the ventilation of the Mahanoy tunnel and the extensive program of rebuilding bridges to carry the heavy consolidation freight engines now in service. The Susquehanna bridge is about 80 per cent completed and the cost given in the table is the total cost for that structure.

Grain elevator at Pt. Richmond	$2,500,000
Rebuilding bridges	1,754,000
Ventilating Mahanoy tunnel	73,000
Filling Ringtown Viaduct	680,000
Camden terminal; piers and ferry slips	2,800,000
Car dumper and pier at Pt. Richmond	1,650,000
Completing Susquehanna Bridge (total)	1,703,000
Signals and interlocking	288,000
Train control system; Camden to Atlantic City	300,000
Buildings at Reading yard	156,000
Freighthouse at East Trenton	45,000
Yard-improvements at Lancaster	17,500
Bridges	83,000
Footway tunnel at Douglasville	35,000
	$12,084,500

Concreting Plant Designed for Cold Weather Work

Special Layout for Group of Buildings in Cleveland Erected During Cold Weather of the Past Winter—Principles of Cold Weather Concreting Outlined

By Richard P. Wallis
The Lundoff-Bicknell Co., Cleveland, Ohio

WINTER concreting is a problem that must be met if the cost of concrete buildings is to be brought down to compete with other types of structure. In the construction of a group of buildings for Western Reserve University and Lakeside Hospital at Cleveland, Ohio, carried out through the past winter, special attention was paid to the design of the plant not only to insure economy, but to insure economy by continuous work throughout the cold weather. The additional cost chargeable to placing the concrete due to winter conditions amounted to 9c. per cu.yd.

The group which will cost approximately $2,500,000, consists of three buildings; a four-story medical school,

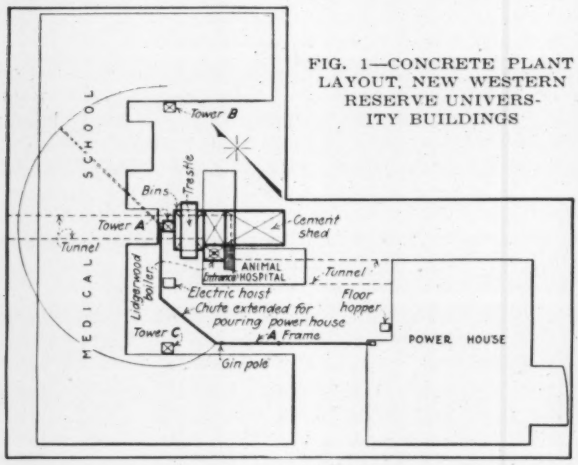


FIG. 1—CONCRETE PLANT LAYOUT, NEW WESTERN RESERVE UNIVERSITY BUILDINGS

308 ft. in length and 62 ft. in width with wings on either end averaging 165 ft. in length, a two-story animal hospital in the form of an L 80 ft. by 70 ft. and 25 ft. in width, both for Western Reserve University, and a power house 112 ft. by 128 ft. and 50 ft. in height including stack 210 ft. high and with an inside diameter of 10 ft. that is to supply heat and power not only to the other two buildings in the group but to the future Lakeside Hospital units that are to be erected on property adjoining this site. These buildings are connected by concrete service tunnels that carry the heating, plumbing and electrical lines from the power house to the various units.

The buildings are constructed of brick, structural steel fireproofed with tile and concrete and reinforced concrete. There are approximately 11,000 cu.yd. of concrete in the entire group, excluding concrete walks and drives.

The site is on level ground and so located as to be inaccessible by direct rail connection. For this reason it was necessary to deliver all concrete materials to the job in trucks and accordingly the concreting plant was designed and built with this limitation in mind.

Plant Layout—A central spot was chosen for the location of the mixer and elevating tower "A." Combined material hoists and secondary towers were erected on the court side of the two wings of the medical school. These towers "B" and "C" serve as supports to the chutes that relay the concrete to floor hoppers whence it is distributed to the more distant parts of the building in buggies.

A 45-ft. gin pole equipped with a double-drum crab and an A-frame serve to support the chutes that convey the concrete from tower "A" to the power house site. As over seventy per cent of the volume of concrete contained in the power house is located below the level of the first floor it was not deemed expedient, in view of the disproportionate cost, to construct tower "A" to a height sufficient to permit of chuting the concrete for the power house superstructure directly into the forms. This concrete for roof slab, coal bins, etc., is re-elevated from the ground level at the power house in buggies on the material hoist and is thus placed at very small additional cost. (Figs. 1 and 2.)

Fortunately it was possible to locate the mixing plant at the point where the service tunnel enters the medical school. At this point the floor of the tunnel steps down to a level 30 ft. below the surface of the ground in order to enter the building at the sub-basement level. By excavating this portion of the tunnel in advance it was possible with a slight amount of additional excavation to locate the mixer and bins practically below grade. This arrangement made it possible to utilize the force of gravity throughout in the handling of the concrete materials back of the mixer. (Fig. 3.)

The bins for the storage of aggregate are constructed of timber with their tops approximately 6 ft. above grade and are so located as to be immediately above the charging hopper. A timber trestle 8 ft. in width with ramps at either end was constructed over the bins forming a continuous way so that the loaded trucks drive up one incline, dump their load through the respective floor gates and continue on down the other incline and out.

There are two separate bins, a sand bin with a capacity of 44 cu.yd. and a stone bin divided into two portions of 44 and 66 cu.yd. capacity, respectively. This latter arrangement makes it possible to stock aggregates of different sizes and kinds and permits of considerable flexibility in the operation of the plant. These bins discharge through short sections of chute to the charging hopper, the flow of materials being controlled by steel shut-off gates operated by hand.

Cement Storage—The cement shed is located back of the mixer and at ground level. This shed is of frame construction covered with roofing paper to make it weatherproof and has the floor raised six inches above the ground and measures 24 by 40 ft. Space is here provided for approximately 8,000 sacks or six carloads and is so arranged that each shipment may be stored by itself. Samples for testing are taken at point of shipment and the cars sealed and released for transit. This cement is not used until after the receipt of the

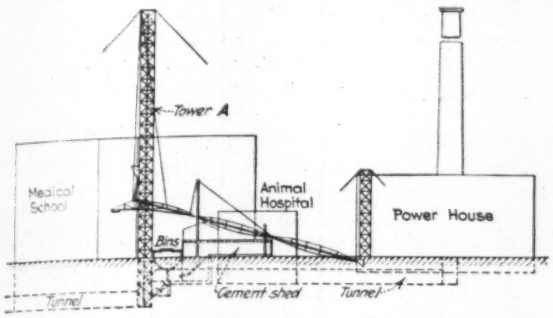


FIG. 2—ELEVATION OF THE MAIN CONCRETE PLANT

report of the seven-day test but as this report is usually received within a day or so following the arrival of the cement very little delay is occasioned thereby. Signs with the car number and the status of the cement are posted in conspicuous locations near each shipment as an aid in seeing that only approved cement is used.

The proper amount of cement destined for each batch is unsacked on the floor of the cement shed and is conveyed to the charging hopper below by a short section of circular chute pitched at the proper angle to permit of a free flow of material. This method of handling the cement avoids the confusion that inevitably occurs when the sacks are emptied on the charging hopper platform. The empty sacks are cleaned in a Handy Sac Cleaner and are counted and baled in bundles of fifty sacks each for ultimate return to the mill.

The water used in mixing this concrete is obtained from city mains and is measured by means of a tilting barrel located at the hopper, the flow being controlled from the hopper floor by a quick-acting valve. Only enough water is used per batch to cause the concrete to flow freely in the chutes. This amount is constantly checked in order to avoid the detrimental effects resulting from excess water in the mix.

The charging hopper is separated into two properly proportioned parts by an adjustable vertical partition. The proper level to which each section must be filled for the batch is determined by filling each section of the hopper with a previously measured quantity of material and marking the level to which the hopper is filled in each case.

Concreting Operations—The ½-yd. mixer is located directly below the hopper floor and is operated by a 15-hp. motor geared direct to the mixer. When properly mixed, the concrete is elevated in a hoist bucket in tower "A." This bucket is operated by a single-drum 55-hp. high-speed electric hoist designed for a speed of 1,000 ft. per min. For better control this speed is geared down to 500 ft. a minute.

Tower "A" measures 175 ft. in height above the bottom of the pit and is built in 7-ft. bents of 6x6-in. posts, 2x8-in. ledgers and cross braces and measures 7 ft. 3 in. by 7 ft. 10 in. out to out. The cross bracing is placed on the outside and the ledgers on the inside of the posts for the additional stiffness to the tower gained thereby.

The hoist bucket discharges into a tower hopper which admits to the chute, which is composed of two 50-ft. sections. The section adjoining the hopper is a trussed chute supported by cables from the top of the tower and the other a counterbalanced trussed section supported from the end of the first section. A counterweight of 2,500 lb. is required to balance this latter section of chute. Additional sections of chute are added to these as required in order to reach the more distant parts of the building. These two sections are connected by a swivel joint and splash hood in order to prevent waste of material. These chutes are pitched with a slope of 3 in. to the foot and are supported on a sliding frame so that together with the tower hopper they may be raised with winches as the work progresses.

The two permanent sections when fully extended reach hoppers in the combined hoists and towers "B" and "C" whence the cement is handled by a 50-ft. section of trussed chute to floor hoppers located in the wings of the building. These combined hoists and towers measure 6x10 ft. out to out and are 98 ft. tall. They are constructed of 4x6-in. posts and 2x6-in. braces and ledgers. The cage operating within has a capacity of three barrows. Provision for supporting the concrete chute is made by means of wood brackets framed into the tower. In this manner it is economically possible to reach all portions of the medical school.

The tower hopper in tower "A" is housed in by a wooden shed fitted with windows in order to protect the laborer, stationed there to regulate the flow of concrete through the chutes, from the wind and cold. This station is connected to both mixing platform and electric hoist by a series of electric bells for signaling purposes.

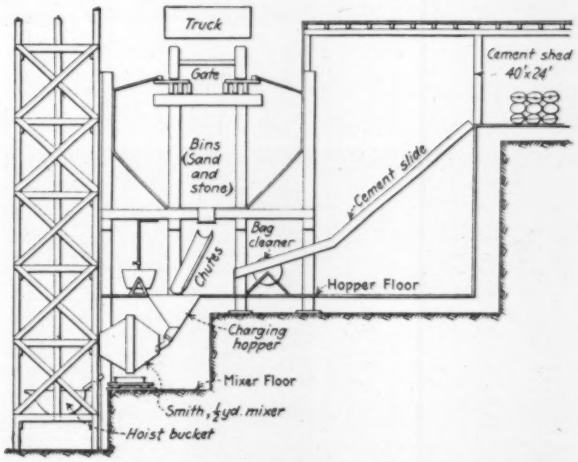


FIG. 3—LAYOUT OF THE CONCRETE MIXING PLANT

The mixing platform is also connected to the hoist in similar manner so that the travel of the hoist bucket is always under control and should anything go wrong it would be possible to stop the bucket before any damage was done to the tower.

The plant is designed to place a maximum of 200 cu.yd. of concrete per 8-hr. day. This amount of concrete requires 110 cu.yd. of sand and 170 cu.yd. of stone which means that the bins must be refilled at least three times for sand and twice for stone during each day of continuous pouring. This amount of concrete requires 300 bbl. of cement per day. Allowing 1,000 sacks or one carload, not released for use, there is still sufficient capacity in the shed for six days of continuous running.

The 11,000 cu.yd. of concrete contained in the structure necessitates the handling of over 6,050 cu.yd. of

sand, 9,350 cu.yd. of stone of different sizes and 16,500 bbl. of cement.

Labor Required—There are required to operate this plant six laborers; one tending the stone and sand cutoff gates, one at the water valve, two handling cement (one at the cement shed and one at the mixing hopper), one dumping the mixer and one stationed in the tower to regulate the flow of concrete to the chutes; two engineers, one at the mixer and one at the hoist; and a foreman. The labor cost incidental to the operation of this plant, exclusive of labor stocking materials and wheeling buggies and puddling the concrete in the forms, is in the neighborhood of $65 per day or an average of $0.32 per cubic yard of concrete poured. The power cost of operating this plant amounts to approximately $10 per day or $0.05 per cu.yd. This latter figure is unusually low as the mixer and hoist constitute the only power-driven equipment in the plant.

FIG. 4—TOWER A, SHOWING RELATION OF BINS, CEMENT SHED AND TRESTLE

Stocking costs for the aggregates are nil, while that of cement amounts to approximately $0.05 per bbl. Had manual labor been employed in the handling of the concrete material back of the mixer it would have necessitated the use of fifteen men instead of the four actually employed to put the batch in the mixer. This means a saving of eleven laborers or $66 per day for a maximum run of 200 cu.yd. or $0.33 per cu.yd., a total saving for the entire job of approximately $3,630 due to the efficient manner in which it is possible to handle the materials on the dry side of the mixer.

As the total cost of the plant back of the mixer amounted to $800 it is evident that the saving effected by its use amounts to 450 per cent, or, in other words, this arrangement paid for itself between four and five times.

The labor cost of mixing, depositing and puddling concrete in the forms varies with the locality for which the concrete is destined and is constant for any particular type and arrangement of plant layout. The equipment and methods for handling concrete on the wet side of the mixer have become more or less standardized resulting in comparatively uniform costs whereas the cost of putting the batch in the mixer varies with the ingenuity shown in the laying out of bins, hoppers, etc., required on the dry side for the unloading, stocking and transportation of the raw materials.

This plant when fully equipped costs in the neighborhood of $7,600, including rentals on certain portions for the estimated duration of the job, the net cost of the remainder of the equipment and the labor cost of building, maintaining and wrecking the plant. This cost amounts to $0.69 per cu.yd. of concrete placed.

Comparing the cost of chuting the concrete from the tower hopper to the forms with the cost that would have resulted had the concrete been buggied from the hopper it is estimated that a saving of $0.26 per cu.yd. was effected.

The 11,000 cu.yd. of concrete contained in the structure were placed at an average labor cost of $0.85 per cu.yd. based on the total cost properly assessable against the concreting operations.

Precautions for Cold Weather—As stated, it was necessary, owing to the fact that the greater part of the concrete was to be placed during the winter months of the year, to lay great stress upon cold weather and frost protection in order that the concrete should be of the proper quality.

The stone and sand bins are equipped with perforated steam coils connected to a 35-hp. boiler. These bins were constructed with covers in order that the heat so imparted may be retained for as long a period as possible. In this manner it was possible to maintain, when weather conditions required, a temperature of about 150 deg. F. This temperature proved to be sufficient not only to thaw out any ice or snow found in the aggregate but to impart sufficient initial heat so that the resulting concrete was well above the critical temperature when placed in the forms. The mixing water was likewise heated to a similar temperature. The cement and reinforcing steel were not preheated as they constitute such a small percentage of the volume of the concrete.

Among the advantages obtained from locating the bins and mixer below ground and in an enclosure was the protection gained by the men working at the mixer from direct exposure to the wind. It was found possible to maintain fairly comfortable working conditions by the use of salamanders placed on the various platforms.

Care was taken to place the warm concrete in the forms immediately after mixing in order to lose as little heat as possible. The temperature of the concrete was tested with a thermometer from time to time to insure its being maintained sufficiently warm to withstand the action of the cold. Every effort was made to keep this temperature around 80 deg. F. All snow and ice were carefully removed from the forms by means of a steam jet before the concrete was deposited.

During the 48 hours immediately after pouring, in the case of moderately cold weather and from three to five days in freezing weather, the new-laid concrete was protected from the action of frost and wind by tar-

paulins enclosing the area in which the concrete occurs. Salamanders burning coke were kept constantly going in order to maintain a temperature of at least 60 deg. F. This temperature was frequently checked in order to prevent its falling below the critical point. The night watchman was charged with the responsibility of keeping these salamanders burning during the night. Buckets of water were kept near all salamanders not only as a precaution in case of fire originating from hot ashes or overheated salamanders but also to provide the necessary amount of moisture for the proper setting action.

Great care was exercised in removing the forms whenever the temperature registered below 50 deg. F. and particularly when the temperature was below 32 deg.

Simple tests were made on the concrete before removing the forms from important portions of the work to determine if the concrete had hardened sufficiently and if so whether due to its having set properly or to freezing. Eight-penny nails were driven into such concrete. If they penetrated, it indicated that the concrete was still soft and that the forms should remain in place. Should the concrete resist penetration it served to indicate that the concrete had hardened. If any suspicion existed that this hardness was due to frost the flames from a gasoline blow torch were directed against the surface of the concrete. If the concrete went to pieces under such treatment it indicated that frost was present and the section must be allowed to thaw after which it might set properly. Due to the thoroughness of the precautions taken very little of the concrete was found to be in this condition.

This work was carried on under the direction of Hugh Cook, representing the contractor, the Lundoff-Bicknell Co.; M. P. Potter representing the owner; and J. J. Deveney representing the architects, Coolidge & Shattuck of Boston, Mass.

Torsional Strength of Reinforced Concrete

Tests of the torsional strength of rectangular sections of plain and reinforced concrete have been made at the University of Toronto and have been published in Bulletin 3 of the University of Toronto School of Engineering Research. Tests were made by Prof. C. R. Young, W. L. Sagar, and C. A. Hughes. They were made on 5 x 5-in., 5 x 7½-in., and 5 x 10-in. beams all 4 ft. long, some plain, some with longitudinal reinforcement, some with medium longitudinal reinforcement and light spirals, and the last with heavy longitudinal steel and close spirals. Twelve test beams in all were made. As a result, the authors state (1) rectangular specimens of plain concrete with various ratios of long to short sides developed substantially the same computed maximum torsional shearing stress at the center of the long side. For 1:2:4 concrete one month old, this is about 540 lb. per sq.in. (2) Longitudinal reinforcement alone is of little value when reinforcing concrete beams for torsion. (3) Spiral reinforcement increases the torsional strength of beams, the increment in strength being approximately proportional to the amount of such reinforcement. Spiralling to the amount of from 0.4 to 1.0 per cent may be expected to increase the torsional strength of a member with or without straight longitudinal rods from 20 to 50 per cent. (4) The torsional modulus of elasticity of plain concrete of 1:2:4 mix one month old averages about 1,500,000 lb. per sq.in.

Efficiencies of Old Reaction Wheels Improved by Rubber Seal Rings

SINCE the advent of rubber seal rings for reaction type waterwheels the idea of fitting such rings to old units to improve operating conditions has been tried out successfully in a number of Western plants. These rings can be installed to good advantage, it is claimed, when a unit has fallen off in efficiency after long service due to seal ring leakage or where sediment in the water makes necessary frequent renewal of the ordinary metal seal rings. The rubber seal rings developed by E. C. Hutchinson of the Pelton Water Wheel Co. were described in *Engineering News-Record* Nov. 9, 1922, p. 789.

Based on the operating experience in Western plants, it is stated that under hard wearing conditions the rubber seal rings will last longer than metal and will also keep water leakage and resultant efficiency loss to a minimum without any danger of internal rubbing or damage. There is no means of figuring exactly the improvement in operating conditions that may be expected from the use of rubber seal rings in old turbines. However, in all cases where they have been put in old units the improvement of efficiency and turbine capacities is said to have made the first cost of the improvement a highly satisfactory investment.

On one California plant, for example, which has been in service more than ten years, the turbine, when new, developed 1,550 kw. with a depth of 37 in. of water in the canal supplying the forebay. After years of wear without renewal of seal rings the output dropped to 1,440 kw. with the same depth of water in the canal. Rubber seal rings were then installed and the turbine output was thereby increased to 1,670 kw., using the same amount of water. This capacity, however, was too great to be carried continuously on the generator and the amount of water admitted to the turbine was reduced to keep the power within limits safe for the generator. The surplus water was then used to operate an old standby unit for which no water supply had previously been available. This standby unit is now delivering 110 kw. and the main unit 1,550 kw. with the same 37-in. depth of water in the supply canal.

In this case, as in most cases of putting the rings in old units, the change is quite simple and involves only the removal of the existing all-metal wearing rings or sealing rings and the substitution of the rubber rings. Usually this is done without other modification of the unit.

The present construction of the seal rings, particularly for high-head turbines, requires that the rubber shall be vulcanized directly into the metal rings. When the rubber becomes worn, however, it is unnecessary to renew the metal ring section as it can be again used for vulcanizing a new rubber facing into it.

The highest head under which rubber seal rings are now used is 350 ft., but similar rings are in process of construction for the Oak Grove turbines which will operate under a head of 850 ft. The largest rubber seal rings thus far made are 5½ ft. in diameter but plans are now being developed for making seals of this type commercially for the very large diameter low-head turbines used extensively in the eastern part of the United States. This plan contemplates the manufacturing of the rubber seals in strips which are then secured to their ring containers.

False Statement of Quantities Unbalances Bid

Practice in Stating Indeterminate Quantities May Provoke Unbalanced Bids—Four Methods Analyzed—Conclusions Drawn

By Clinton L. Bogert
Teaneck, N. J.

IN RENDERING a balanced bid the contractor relies on the "Approximate Statement of Quantities" prepared by the engineer; he assumes that this list represents comprehensively the nature of the undertaking. A large responsibility, therefore, rests on the engineer to make his statement as nearly as practicable representative of the character of the work to be performed and of the materials to be delivered. In other words, the "Approximate Statement of Quantities" should be as faithfully balanced as it is expected the contractor's bid will be.

Unfortunately, conditions beyond the control of the engineer often militate against completeness in the approximate statement of quantities. City councils are notoriously loath to appropriate money for any purpose previous to the signing of the contract; even a few dollars for test-pits are difficult to obtain. On small municipal jobs, particularly, this inhibition of expenditures for borings and other subsurface studies often makes it impossible to do any testing and thus puts the engineer in a quandary.

Bid prices must have as their basis the "approximate statement of quantities" in the preparation of which the engineer has one of four courses open to him as regards the uncertain items:

1. Place the quantity at some conveniently round nominal figure; this is a widespread practice.

2. Use a figure high enough to be certain that it cannot be exceeded.

3. Prepare as careful an estimate as possible based on final estimates from similar structures similarly conditioned, and explain fully to the bidder the nature of the estimate.

4. Ignore the minor items entirely in the approximate statement of quantities and pay for such as extra work.

Unknown Items Estimated Low—This practice consists in inserting some conveniently round number, say 10, 50, 100, opposite the unestimatable item. In reality this procedure unbalances the approximate statement of quantities, leaving the way open for some unscrupulous bidder to profit at the expense of the municipality. A concrete case is given in the table based on a canvass of bids published within the last year in the Construction News section of *Engineering News-Record*.

The canvass of but two bids is here shown. A. S. Usual bid according to his best judgment in the light of the drawings and specifications and a visit to the site. On the other hand, A. Local Wise has done work in this locality previously and suspects that there will be several hundred feet of some of the pipe sizes tabulated as 100 ft. long, and that there will be a considerable quantity of rock. Acting on this hunch, he prepares his bid-prices according to his usual procedure, and then shades off a few hundred dollars from the subtotal of items 1-9, and adds them judiciously to items 10-24. On the known items, 1-9, Wise is $3,000 under Usual, while on the total Wise is but $1,000 under. Being the lowest bidder and a local man he gets the contract.

Later when the progress of work has disclosed the actual quantities of items 10-24 the comparison is quite different. There has been inserted in the table what might be considered a fairly representative final estimate for this type of work—one not beyond the realms of reason on small-town contracts. The resulting figures require no explanation.

Unknown Items Estimated High—This is not common practice, but is not unknown. It is unfair to the contractor, even on minor items, as it leads him to plan his plant and to allocate his overhead charges on the basis of a certain large quantity of work. Again, if the total of the bid price is run up by their insertion to such a figure as to create a wrong impression of the ultimate cost the council may be put in a state of mind to delay for months a much-needed public improvement. In brief, unbalancing the statement of quantities by the adoption of excessive figures for the unascertainable items works an injustice on the contractor which may lead to a costly court action; and it deceives the council as to the final cost.

METHOD OF UNBALANCING BIDS WHEN NOMINAL VALUES ARE GIVEN TO INDETERMINATE QUANTITIES

Accuracy of Statement of Quantities	Item No.	Class	Cost to City Based on Statement of Quantities: Preliminary Estimate	A. S. Usual, Bidder: Unit	A. S. Usual, Bidder: Total	A. Local Wise, Bidder: Unit	A. Local Wise, Bidder: Total	Cost to City Based on Final Estimates: Final Estimate	A. S. Usual, Contractor: Unit	A. S. Usual, Contractor: Total	A. Local Wise, Contractor: Unit	A. Local Wise, Contractor: Total
Quantities estimated from surveys, etc.	1	Earth excavation, 0–6-ft., cut	10,000 cu.yd.	$0.50	$5,000	$0.65	$6,50	11,000 cu.yd.	$0.50	$5,500	$0.65	$7,150
	2	Earth excavation, 6–9-ft., cut	3,000 cu.yd.	.80	2,400	.70	2,100	4,000 cu.yd.	.80	3,200	.70	2,800
	3	Earth excavation, 9–12-ft., cut	2,000 cu.yd.	1.00	2,000	1.00	2,000	2,000 cu.yd.	1.00	2,000	1.00	2,000
	4	Earth excavation, 12–15-ft., cut	1,000 cu.yd.	2.00	2,000	1.25	1,250	1,000 cu.yd.	2.00	2,000	1.25	1,250
	5	Earth excavation, 15–18-ft., cut	500 cu.yd.	3.00	1,500	2.00	1,000	500 cu.yd.	3.00	1,500	2.00	1,000
	6	Earth excavation, 18–21-ft., cut	200 cu.yd.	4.00	800	3.00	600	200 cu.yd.	4.00	800	3.00	600
	7	42-in. reinforced concrete pipe	8,000 ft.	5.50	44,000	5.20	41,600	8,000 ft.	5.50	44,000	5.20	41,600
	8	39-in. reinforced concrete pipe	1,000 ft.	5.10	5,100	4.60	4,600	1,000 ft.	5.10	5,100	4.60	4,600
	9	C. I. pipe, etc.	20 tons	70.00	1,400	80.00	1,600	22 tons	70.00	1,540	80.00	1,760
		Sub-total of Items 1–8			$64,200		$61,250			$65,640		$62,760
Quantities inserted to "get a price"	10	4-in. vitrified pipe	100 ft.	$0.15	$15	$0.45	$45	800 ft.	$0.15	$120	$0.45	$360
	11	6-in. vitrified pipe	100 ft.	.25	25	.80	80	600 ft.	.25	150	.80	480
	12	8-in. vitrified pipe	100 ft.	.40	40	1.20	120	700 ft.	.40	280	1.20	840
	13	10-in. vitrified pipe	100 ft.	.60	60	1.60	160	.....	.....	.....	.....	.....
	14	12-in. vitrified pipe	100 ft.	.80	80	2.00	200	.....	.....	.....	.....	.....
	15	15-in. vitrified pipe	100 ft.	1.00	100	2.40	240	200 ft.	1.00	200	2.40	480
	16	18-in. vitrified pipe	100 ft.	1.20	120	2.70	270	400 ft.	1.20	480	2.70	1,080
	17	20-in. vitrified pipe	100 ft.	1.40	140	3.00	300	.....	.....	.....	.....	.....
	18	22-in. vitrified pipe	100 ft.	1.60	160	3.30	330	200 ft.	1.60	320	3.30	660
	19	24-in. vitrified pipe	100 ft.	1.75	175	3.50	350	300 ft.	1.75	525	3.50	1,050
	20	Concrete, Class A	10 cu.yd.	14.00	140	25.00	250	30 cu.yd.	14.00	420	25.00	750
	21	Concrete, Class B	20 cu.yd.	12.00	240	20.00	400	60 cu.yd.	12.00	720	20.00	1,200
	22	Concrete, Class C	30 cu.yd.	10.00	300	15.00	450	50 cu.yd.	10.00	500	15.00	750
	23	Brick masonry	10 cu.yd.	25.00	250	40.00	400	20 cu.yd.	25.00	500	40.00	800
	24	Rock excavation	50 cu.yd.	4.00	200	9.00	450	400 cu.yd.	4.00	1,600	9.00	3,600
		Sub-total of Items 9–24			$2,045		$4,045			$5,810		$12,050
		Totals			$66,245		$65,295			$71,450		$74,810

Unknown Items Estimated Carefully—This method provides the nearest approach to a balanced statement and probably constitutes the best practice although many engineers favor the extra work alternative. The inability to ascertain the full extent of all the work to be done under a contract is no excuse for the slovenly use of round numbers, nor for extravagant figures. Every engineering office has in its files the final estimates and the contracts of similar work done, from which can be derived some relative figures between the known and unknown items which can be put to practical use. After the preparation of as comprehensive a statement of quantities as the nature of the work permits, take the contractor into confidence and explain to him the conditions of the estimate and what conditions encountered may alter the figures.

Unscheduled Work Classed as Extra Work—During the life of a municipal contract so many alterations may be required by the authorities that some engineers despair altogether of getting out a comprehensive and balanced approximate statement of quantities and swing to the other extreme of inserting only the items which can be estimated, leaving all others to be classified as extra work.

Extra work always opens the way for innumerable squabbles as to what constitutes the cost of the work so done, and especially as to the apportionment of overhead charges to such work. Moreover, extra work bills generally have to be passed by the City Council, which affords opportunity for discourses relative to the competence of every one concerned. This alternative also misleads the council as to the final cost of the work, since the canvass of bids, which councilmen often pin their faith to as representing the ultimate expenditure for a project, was totalled excluding these items. Here again we see the evils attendant on an unbalanced statement of quantities.

Conclusions—The estimating of the unascertainable quantities at too low a figure has been shown to be a means of mulcting the public treasury when a bid is once accepted. There is no relief to the city from the contractor's high prices. It can work no hardship on a contractor who wants to resort to law, as he can expect relief from low prices.

The placing of excessively high figures works no good to any one.

The resort to the "extra work" clause to cover items which are purposely ignored when preparing the approximate statement of quantities, should be had only in extreme cases.

The use of a carefully prepared estimate, with adequate cautions to the bidder undoubtedly constitutes the nearest approach to a balanced statement of quantities, and as such should be looked upon as standard practice for small as well as large works.

Indiana to Build 235 Miles of Road in 1923

A total of 235 miles of road will be constructed by the Indiana State Highway Commission this year, according to John D. Williams, director of the state highway department. Projects now under way, to cost $2,254,131, include 20 mi. concrete pavement, 2 mi. sheet asphalt on concrete base, 2 mi. bituminous concrete on concrete base, 2 mi. Kentucky rock asphalt, 1 mi. bituminous macadam on waterbound base, 3 mi. waterbound macadam, 10 mi. gravel, and 1 mi. stone. There are forty county projects carried out under state approval and inspection.

Traffic Center Lines on Roads

Committee report submitted May 10 to the annual meeting of the National Highway Traffic Association in New York, by Frank T. Sheets, State Superintendent of Highways of Illinois.

THE USE of traffic center lines on highways is becoming more and more popular in the United States. In the case of a road having a paved width sufficient to accommodate two lines of traffic the safety of the highway users may be increased from 25 to 50 per cent by the addition of a traffic center line. This conclusion has been reached after an observation of the habits of traffic on two-track roads where a center line has been introduced. Further, it is based upon the unsolicited complimentary remarks which have been received from the traveling public immediately after such a line was introduced.

When a traffic center line is used the drivers no longer pass each other with a more or less uncertain clearance between the vehicles, but approach each other with confidence, using the center line as a positive visible gage on the driver's side, and knowing that the clearance thus afforded will insure absolute safety in passing, without any danger of running off the unseen outside edge of the pavement.

On curves, the traffic center line is of even greater advantage than on the tangents, and even if not used on the latter it should be painted on all curves having a radius less than 1,000 ft. This center line should extend not less than 400 ft. beyond each end.

In the case of the so-called non-rigid or flexible types of pavement construction on macadam or other flexible bases the use of traffic center lines might tend to force traffic into well defined lanes and thus cause rutting or undue wear. However, on heavily traveled roads the safety of the traveling public is of greater importance than the safety of the pavement surface. In the case of the so-called rigid types of pavement, such as portland cement concrete, brick, bituminous concrete or sheet asphalt on a concrete base, which are the predominating types in this country, the traffic center line will materially increase the structural safety of the pavement by tending to eliminate travel near the extreme edges of the pavement, where the outside edges and the unprotected corners caused by construction joints or by transverse contraction cracks are the most dangerous and critical sections from a structural standpoint.

Center Joint a Guide—One of the embarrassing defects encountered in concrete pavement slabs having a width greater than 16 ft. is the formation of unsightly longitudinal cracks brought about by the combined stresses produced by nature and traffic. To eliminate such cracks the center of the pavement must be thickened to a dimension not justified by economy. However, this may easily be circumvented by introducing a longitudinal center construction joint dividing the normal two-track country pavement having a width of 18 ft. into two 9-ft. sections. Slabs 9 ft. in width have never caused any difficulty so far as longitudinal cracking is concerned. By proper interlocking and tying together of these two 9-ft. strips the interior portion of the pavement may be made practically as strong as an unbroken slab, and certainly far more efficient than a pavement divided by an irregular longitudinal crack. This center construction joint may be kept filled with bituminous material and painted with a line approximately 3 in. in width. In this manner, the traffic center line and the longitudinal construction joint may be introduced in one operation, with the result that the unsightly longitudinal cracking is eliminated, traffic safety is assured, and highway engineers may cease to perpetuate the indefensible evil practice of causing doubt, criticism, and mistrust in the mind of the traveling public by designing and building pavements which fail structurally by longitudinal cracking even before traffic is introduced.

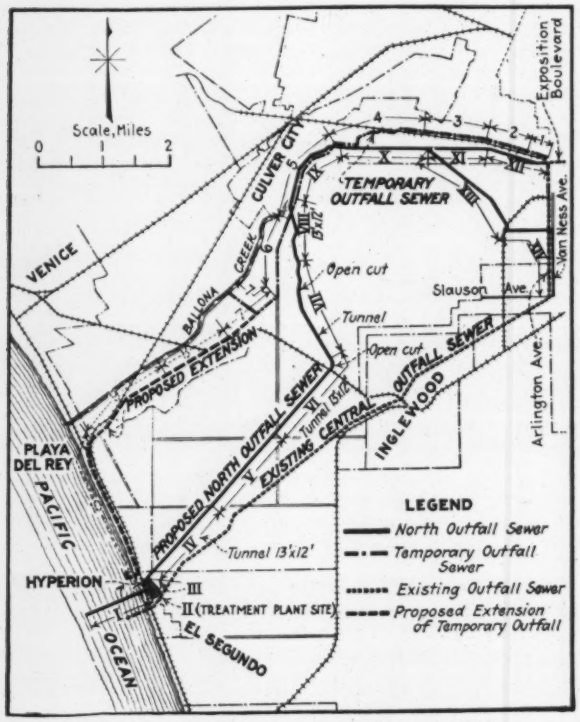
The combined center line construction joint and painted traffic center line are being used in Illinois on all pavements built on the 4,800-mile state trunk-line highway system, which is being pushed to completion at the rate of 1,000 miles per year, and also on all county roads in the state.

Los Angeles Sewage Disposal Plans Assuming Final Form

Trunk Sewers, Screens, and Ocean Outfall—Venice Co-operation May Make Temporary Sewage-Works Unnecessary

By W. T. Knowlton
Engineer of Sewers, Los Angeles, Calif.

SINCE a report by the writer on the construction of the new Los Angeles outfall sewer and sewage treatment plants, published late last year (abstracted in *Engineering News-Record*, Dec. 28, 1922, p. 1116), plans and specifications for most of the different sections of the new outfall have been prepared. The total length of the new outfall will be 15.4 miles, of which 7.2 miles will be of a semi-elliptical design with a height of 12 ft.



PRESENT AND PROPOSED SEWER OUTFALLS AT LOS ANGELES

City sewage received by the central outfall sewer shown at the extreme right edge of the map is now delivered to the ocean at Hyperion. Pending construction of the large outfall sewer (shown by solid lines with contract sections indicated by Roman numerals) a temporary pipe line of smaller size is being built along Ballona Creek (indicated by dash-and-dot and broken lines and by Arabic numerals).

and a width of 13 ft. Most of this portion of the sewer will be laid in tunnel, only two miles being in open cut. The remaining portion of the new outfall, Sections IX to XIV inclusive, will be a circular sewer, varying from 4 ft. 9 in. to 8 ft. 6 in. in diameter. The general location of the new sewer is shown on the accompanying map, the different sections being indicated by Roman numerals. The map also shows the temporary outfall which is being built along Ballona Creek to relieve the present emergency until the larger outfall can be finished.

Three types of construction are under consideration for the circular sections of the permanent outfall: (1) A brick arch resting on a concrete invert and base, with vitrified brick for the entire inner circle; (2) a segmental block resting on a concrete base and with concrete reinforcement on the sides; and (3) precast reinforced-concrete pipe with a vitrified-tile lining, this type also resting on a concrete base. For the 12 x 13-ft. sections the choice will be between (1) a brick arch on a concrete base with vitrified brick for the inner ring and (2) large segmental block for the upper quadrant and segmental block lining for the remainder of all of the interior surface above the concrete base, with concrete reinforcement on all sides excepting the upper quadrant.

The depth of the sewer in Sections X to XIV, inclusive, will average 18.3 ft. Borings indicate that considerable ground water will be encountered in all of these sections. On Sections VII to IX, inclusive, ground water will probably be encountered at irregular intervals. Borings made not far from the sewer line in Sections IV to VI indicate that sand and no water will be found. Arrangements for making connections at the upper ends of Sections XII and XIV with the existing outfall sewers are planned upon the completion of the new outfall. No direct house connections are planned to be made to this new sewer, except as has been mentioned and except for a connection to be made at the upper end of Section VIII with the sewers of Culver City.

During the first four months of this year considerable progress has been made on the temporary outfall sewer, the contract sections of which are shown by Arabic numbers on the map. Plans for Sections 5 and 6 have been made and a contract has already been awarded for Section 5. Sections 1, 2 and 3 of the temporary outfall have been completed, and it is expected that Section 4 will be completed by July 1. Upon the completion of Section 5, the temporary outfall will carry the excess flow of sewage from the present outfall at Arlington Ave. and Rodeo Road to a point below Culver City. The approximate cost of Sections 1 to 5 inclusive is $282,200 and the length 5.36 miles.

The original plan of having the flow of sewage in this temporary outfall treated and then discharged into Ballona Creek will probably be abandoned, if arrangements which have been considered are made with the City of Venice. These arrangements would cover rights-of-way across that part of the City of Venice called Playa del Rey, so as to permit of the extension of the temporary outfall from the treatment plant site south of Culver City to Playa del Rey, and thence south to the Hyperion property of the City of Los Angeles. This change will relocate Section 7 and add Sections 8, 9 and 10. After giving the City of Los Angeles these rights-of-way, the City of Venice would expect to receive a permit to discharge the sewage from the City of Venice into the temporary outfall at Playa del Rey.

The capacity of Sections 7, 8 and 9 will be the same as that of section 6, namely, 45 sec.-ft., as no sewer connections between Culver City and Playa del Rey will be made to this temporary outfall sewer. Furthermore, Sections 6 to 10, inclusive, of this sewer will be under pressure, so that a suitable type of construction must be provided. The present plan is to use either wood-stave or reinforced-concrete pipe for Sections 7 to 9 inclusive, and reinforced concrete for Section 10, the reason for the latter type for Section 10 being that it will be laid along the coast where the use of wood stave would not be applicable.

The bond issue for $12,000,000 voted on August 29,

1922, was planned to cover the construction costs of the new outfall sewer, the temporary outfall to and including the treatment plant south of Culver City, also the treatment plant at Hyperion. With the omission of the treatment plant south of Culver City, this bond issue will be sufficient to cover the proposed extension of the temporary outfall to Playa del Rey, and thence to Hyperion.

Work on Section II at the lower end of the new north outfall sewer has already been started, this section covering the removal of the sand hills where it is planned to install a sewage-screening plant. The contract for Section II includes excavating and dumping into the ocean approximately 700,000 cu.yd. of material. The contract price for this section is $97,704, or approximately 14c. per cubic yard.

Plans and specifications for the pipe proposed for the ocean end of the new outfall sewer, Section I, have been prepared. Although cast-iron pipe was originally planned for this section, it has been decided recently that an alternative installation of precast reinforced-concrete pipe could be used in place of cast iron. The internal diameter of this pipe is 84 in. for the first 5,145 ft. from shore, at which point the depth is about 50 ft. Here the 84-in. pipe will divide into two 60-in. branches at right angles to each other and 45 deg. from the main line axis. These 60-in. branches will each be extended 283 ft. further from shore where the depth is approximately 56 ft. Special fittings for the pipe at the lower ends of these two branches will be made so that the sewage will discharge upward at a point about 3 ft. above the ocean bottom. The pipe of Section I will be laid just below the ocean bottom and be protected against tidal action by bulk concrete and backfill. Novel methods have been devised for the laying of this line by submerging caissons carrying three lengths fastened together on shore.

Borings made below the ocean indicated that the bottom is sand for a depth of at least 10 ft. below the floor, and in some places these borings indicate nothing but sand for a depth of 20 ft. Soundings made show the ocean floor to have a slope of about 1 per cent from high tide outward to and beyond the proposed ends of Section I.

Section III of the north outfall includes the different portions of the screening plant and work incidental thereto. Plans and specifications for the south portion of the screening plant have been completed and bids therefor were opened by the Board of Public Works on May 7. These screens will be of the horizontal-drum type and the screenings will be removed by elevators to a dryer, or to beds where they can be covered. Other plans for this section include the connecting sewers, buildings, and road work.

The policy of the city will be to do all this sewer work by contract if the proposals received are not excessive. The preparations of all plans and the construction work to follow are under the general supervision of Major John A. Griffin, city engineer.

Work Resumed on 89 Forest Road Projects

The Bureau of Public Roads of the United States Department of Agriculture reports that there are 89 projects involving 717 miles of road upon which work is being resumed and a number of new projects for which contracts have been let and that 175 projects involving 1,487 miles of forest road have already been completed.

Snow Survey and Stream Runoff Forecast in Nevada for 1923

STREAM FLOW in Nevada during the coming spring and summer is likely to approximate normal conditions, according to the April forecast of J. E. Church. Jr., Reno, Nev., who is in charge of the co-operative snow survey conducted jointly by the State of Nevada and the Nevada section of the U. S. Weather Bureau. This snow-survey system has been described in *Engineering News-Record* of Oct. 23, 1919, p. 766; Sept. 9, 1920, p. 429, and Feb. 10 and 17, 1921, pp. 244 and 300. A summary of the report is given below:

The snow cover in the Central Sierra varies from 99.4 per cent in the Yuba-Truckee basins in the north to approximately 92.0 per cent in the Stanislaus-Tuolumne-Walker basins in the south. No shrinkage is probable in the percentage of runoff indicated by the snow cover, for 75 per cent of the normal April-July precipitation fell during the first week of April and further precipitation may reasonably be expected. However, since the snow cover is below normal, a late runoff seems improbable. In fact, the extraordinarily high density of the snow cover April 1 and its consequent inability to retain water by capillarity indicates a somewhat earlier runoff than would otherwise occur. Only summer and autumn rains can keep the streams at late normal stage.

The snow cover in the Humboldt basin varies from 82.9 per cent on the northern feeders to 103.1 per cent on the southern, or an average of 93.0 per cent for the basin. The snow cover of the Little Humboldt basin is somewhat heavier, being 117.6 per cent. The April-July precipitation in the Humboldt basin gives no assurance as yet that shrinkage can not occur there in the runoff. Under maximum shrinkage, the loss should not exceed 25 per cent of normal, leaving a net runoff of at least 68.0 per cent in the Humboldt River at Palisade, and 92.6 per cent in the Little Humboldt River at the head of Paradise Valley.

Contrary to age-long tradition, the loss in water content of snow in the Humboldt quadrangle must be due to high relative density which deprived the snow cover of its spongy character and ability to hold melting water in suspension. This extraordinary density was due to the lack of snowfall in February and March, which gave the earlier snow an opportunity to ripen without addition of new snow to decrease the average density. If the usual amount of new snow had fallen in March, the lower and compact snow would probably have been insulated against the normal temperature then prevailing. A loss of this nature has never previously been detected during the fifteen years of the snow studies.

Forecast—Since both the temperature and the elevation of the snow line were normal in March, no increase in the April flow can be expected from the deficient runoff of March, which was due mainly to the almost complete lack of precipitation during this and the previous months. In fact, owing to the abnormal density of the snow cover, some of the water belonging normally to the April flow ran down in March or saturated the soil. This occurred at elevations as high as 8,000 ft. However, this loss has been eliminated from the April-July estimate.

Moreover, in the Central Sierra the heavy precipitation of 3.01 in. at Tahoe City April 1-7, which amounted to 75.8 per cent of the normal for the entire period of April-July, indicates that no shrinkage in the stream flow below the percentage indicated by the snow cover will probably occur, and that such shrinkage at most can not exceed 20 per cent for Lake Tahoe and 10 per cent for the streams.

However, in the Humboldt Basin, the precipitation thus far in April has been too light to give any assurance against possible shrinkage. While the runoff can now be closely forecasted in the Central Sierra, only the extremes of runoff in the Humboldt Basin can be given at the present time, a more definite forecast being deferred until a later date.

Thin Concrete Revetments on the Sacramento River

Two Inches of Reinforced Gunite in Test Section—Mistakes in Methods Used—Concrete Slab for Second Section

AS AN experiment in checking the erosion of the banks of the Sacramento River, below Sacramento City, a section of one of the slopes was covered with a gunite revetment placed during the winter of 1922. The specifications called for a 2-in. layer of reinforced gunite of 1:3 mix, placed directly on the slope which was a mixture of fine sand and coarse gravel. The revetment was about 540 ft. long and from 40 to 60 ft. wide. The gunite was placed down to the water's edge and there terminated without any protection. No provision was made for expansion joints nor was any method used whereby the thickness of the slab could be determined. It also appears that the specified proportions for the gunite were not maintained throughout, that they sometimes dropped as low as 1:9.

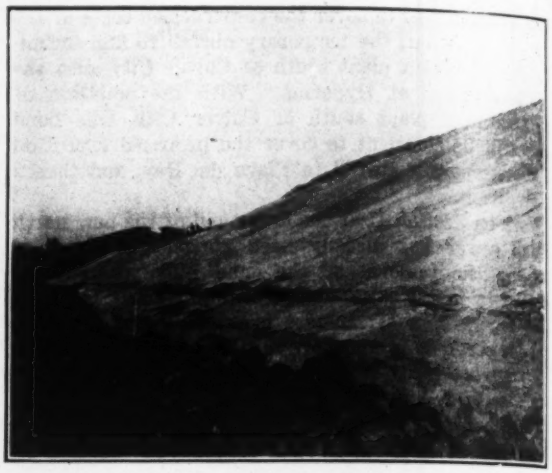
The heat and floods of the following season brought out the defects in the method used. Expansion cracked and broke the slab at many points where, instead of being 2 in. thick, it is only ½ in. thick. Then the floods scoured out the openings so made and also cut away

GUNITE BANK PROTECTION WITH CONCRETE TOE WALL

the sand and gravel under the lower edge of the revetment, allowing portions of it to drop down and break off.

Benefiting by the experience so gained, the damaged revetment was later protected along its edges and at the toe by a wall 2 to 4 ft. deep, and all the holes were repaired by a new layer of gunite of the proper thickness and proportions. This work was done in October, 1922. Since then the revetment has successfully withstood the attacks of the river. But, as a whole, the experiment in using gunite was so unsatisfactory that in extending the revetment upstream for a distance of 600 ft. a 4-in. layer of concrete was used. This new slab is provided with a toe wall and with longitudinal expansion joints every 20 ft., and one horizontal expansion joint about 25 ft. above the toe wall. The cost of this new extension was 14c. per square foot while under favorable conditions the cost of the gunite work was from 17 to 19c. per square foot.

In fairness to gunite it should be said that the partial failure of this piece of revetment does not necessarily prove that gunite might not be as satisfactory as a concrete slab if placed in the summer or fall, at low water, with proper toe protection and expansion joints, and proper thickness and uniformity of mixture.



CONCRETE PROTECTION—EXTENSION OF GUNITE WORK

A small section of gunite bank protection was placed in October, 1919, in front of the irrigation pumping plant on the Sacramento River levee of Reclamation District No. 1,000, and has proved entirely satisfactory.

The information in the above report was taken from a letter by Melville Dozier, Jr., general manager, The Reclamation Board, Sacramento.

Public Water Supplies in Pennsylvania

From the forthcoming report of the Pennsylvania Department of Health

AT THE close of the year 1920 there were 150 filtration plants on public water-works in Pennsylvania. In each of the two succeeding years 7 additional plants were put into operation. At the close of 1922 the total was 163, one plant having been abandoned during 1922, the district formerly served from this plant being supplied with filtered water from another source.

Of chlorinating plants there were 154 in place at the end of 1920, this including modern-type chlorine gas outfits and also chlorinated lime plants, ranging from a simple arrangement of barrels to the more permanent concrete or wooden tanks. During 1921, 59 additional plants were built and in 1922 the total was further increased by the installation of 38 plants. Accordingly, at the end of 1922, there were 247 chlorinating plants on the public water-works in Pennsylvania, 2 having been abandoned during 1921 and 2 others in 1922.

There are slightly more than 650 public water-works in Pennsylvania and of this total at the close of 1922 there were 410 having either filtration or chlorinating apparatus as an essential part of their equipment.

CITY POPULATION IN PENNSYLVANIA SERVED BY PUBLIC WATER

	Population	Per Cent
Urban	6,190,000	72
Rural	2,530,000	28
Total	8,720,000	100

SERVED BY PUBLIC SUPPLIES

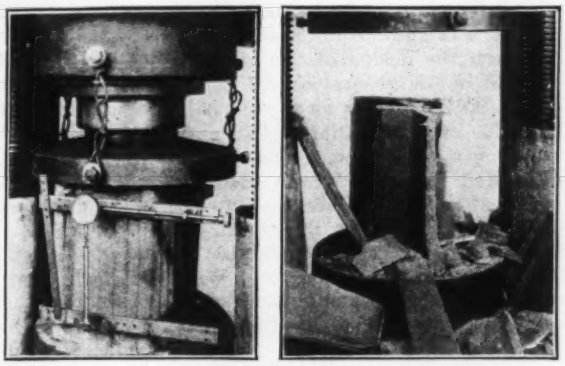
	Population	Per Cent
Urban	6,190,000	100
With filtered water	4,330,000	70
With chlorinated only	1,430,000	23
With untreated	430,000	7
Total	6,190,000	

Cement Gypsum Caps Best for Tests of Hollow Building Tile

Bureau of Standards Tests Tile with Various Cappings—Caps of 3:1 Portland Cement-Gypsum Give Highest Strength

TESTS recently reported before the American Ceramic Society by Harry D. Foster of the Bureau of Standards, and shortly to be published in the *Journal* of that society, clear up the difficulties that have heretofore affected tests of hollow building tile with respect to the proper way of providing an end bearing for the tile in the tests. Large differences in test results and other discrepancies have caused many disputes, and it has long been suspected that the nature of the end bearing of the tile as provided by the tester was responsible for these variations.

In the Bureau tests, different tiles were capped with either neat portland cement, 2:1 or 3:1 mixtures of cement and gypsum, or straight gypsum, or the ends of the tile were ground plane and were not provided with mortar capping. They were tested at different ages



TILE UNDER TEST AND TYPICAL FAILURE

from the time of molding the cap, the ages ranging from one to three hours for gypsum and up to 10 days for neat portland cement capping. No difficulty was found in obtaining consistent results and good compression failures as shown typically by the right-hand view herewith.

It was found that capping of 3 parts of cement to 1 part of gypsum, the tile being tested at the age of seven days, gave the highest strength. Neat gypsum or cement-gypsum mixtures at one to three hours gave about 88 per cent, and neat portland at 10 days and cement-gypsum capping at three days about 93 per cent of that strength. With the softer caps and with the neat portland cement cap, snapping sounds due to adjustments at the high spots were heard at earlier periods of the tests than with a cement-gypsum cap seven days old. In the case of the neat cement cap this is attributed to the yielding consistency of the cement, permitting the tile to sink through the capping material in the process of molding, so that not much thickness of cap is left at the projecting points of the tile, while with the softer capping materials a certain slipping action is introduced. Comparative tests of capped tile and tile with ground ends tested without caps showed no decided difference in strength. There was apparently no large amount of lateral restraint at the bearing faces, in the case of the tile with ground ends, as indicated by the fact that parallel tests of tile 6 in. and 12 in. high gave identical results.

Hydraulic bearings for the tile were not found to be satisfactory. If the bearing was of such character as to give reasonably even bearing on the tile, it had a sufficiently large lateral expansion to set up stresses tending to split the tile.

Measurements of the relative deformation of the capping and of the tile itself in the compression tests showed that with neat gypsum and with cement-gypsum mixtures at ages up to three hours the compression of the cap was much larger than the compression of the tile, while with the cement-gypsum mixtures at ages of three days and upwards and with the neat cement cap the total deformations of cap and of tile were the same.

It was concluded from the tests that consistent and high results can be attained with capping of a mixture of three parts of portland cement to one part of gypsum, aged seven days before the test. Where immediate testing is required, a cap of neat gypsum should be used, and the test should be made not earlier than one hour after molding the cap; the result will be smaller than with the cement-gypsum cap at greater age.

The method of molding the caps used in this test series is described as follows: The bearing surface and adjacent parts of the tile were first coated with shellac to keep the tile from absorbing water from the capping material. Then a quantity of capping material mixed to a consistency slightly thinner than normal was spread on a glass plate coated with oil; one bearing surface of the tile was then set in this plastic material and, the tile being held vertical, a single firm pressure was applied. As soon as this cap had hardened sufficiently so that the tile could be moved, the other bearing surface was capped in the same way. The caps so formed were $\frac{1}{8}$ to $\frac{1}{4}$ in. thick. With neat gypsum and cement gypsum mixtures, a capped tile could be removed from the plate within 15 min., but with neat cement the tile could not be removed for from six to eight hours.

Motor Truck Competition with Railways

COMPETITION of highway motor truck service with the railways is the subject of a statement in the annual report of the New York, New Haven & Hartford R.R. for 1922, as follows:

The competition of motor trucks still continues during favorable weather, to the lessening of your company's revenue and the detriment of the highways over which they run. There are signs that public opinion is coming to realize that if it is to have efficient rail transportation it must not handicap the railroads by subsidizing the motor trucks. Such a subsidy is created by maintaining highways free of any charge more than a nominal one, and by shifting to the taxpayers the expense of keeping up these highways, a considerable part of which falls upon the tax-paying railroads who are thus handicapped by a subsidy which they pay to their competitors.

Common justice should impose upon the operators of motor trucks who offer themselves to the public as common carriers, the same duties and liabilities as are imposed upon common carriers by rail. The necessity of their operation in the public interest should be first established by a state public utility commission. The continuity of operation upon a regular schedule in bad weather, as well as good, should be imposed upon them as upon the railroads and they should be made to pay for their use of the highways. The handling in Connecticut of the problems of jitney competition with street railways points the way to a similar treatment of motor trucks.

Flexible Propelling Gear of Large Navy Yard Crane

Special Wheel Support and Drive for Operation on Curves and to Carry Great Load on 22-Ft. Wheel Base

EXTREME requirements as to load capacity and reach, combined with limitations as to wheel load, were specified by the U. S. Government last year in calling for the bids for a self-propelling outfitting crane of the luffing-boom type for the Boston Navy Yard. As the dock on which it was to operate was not designed for very great concentrated loads, a large wheel base was required. The crane also had to be capable of traveling on a curve of minimum radius 78½ ft., under full load at extreme reach. In order to meet these requirements it was necessary to provide a large number of wheels, as shown by the view, Fig. 1, with the load properly equalized, and to arrange them in swiveling groups for curve flexibility. For sufficient tractive power to make the crane able to propel itself on the curve under the worst position of loading a large proportion of the total number of wheels had to be driven.

These various requirements were met by a new construction of the crane carriage, designed by the builders of the crane, the McMyler-Interstate Co., of Bedford, Ohio. In this construction the carriage is supported on thirty-two wheels, an equalized group of eight wheels under each corner, all arranged in swiveling two-wheel trucks. Four wheels of each group are driven, or half the total number of supporting wheels. As the driven wheels change position with respect to the carriage frame on curves, the propelling power is conveyed to them by sliding drive-sleeves on transverse shafts made flexible by pairs of universal joints.

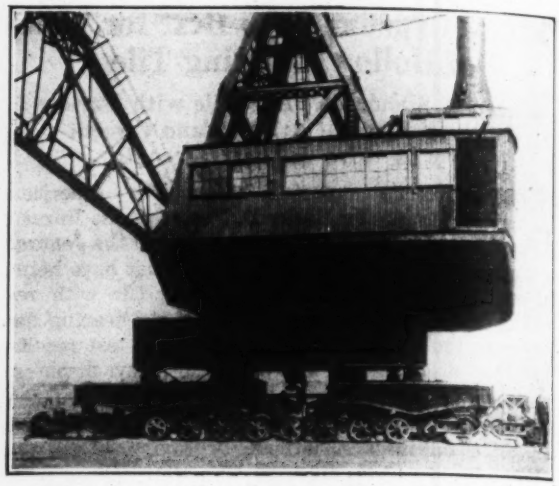


FIG. 1—CARRIAGE OF 50-TON NAVY YARD CRANE

What was specified in regard to loads and reaches to govern the design of the crane in question is represented in the general elevation drawing, Fig. 2: 50 tons at 90½ ft. radius on a main hoist, 15 tons at 129½ ft. radius on an auxiliary hoist, and 5 tons at 133 ft. radius on a whip hoist, all fixed on the jib. The loads are stated in gross tons (2,240 lb.). The drawing indicates by dotted lines the extreme position of the jib, and by solid lines the working position in which the specified reaches are obtained; the height of hook lift in this position is given. With the small wheel base of 22 ft., the amount and position of the counterweight are so adjusted that the center of gravity of the

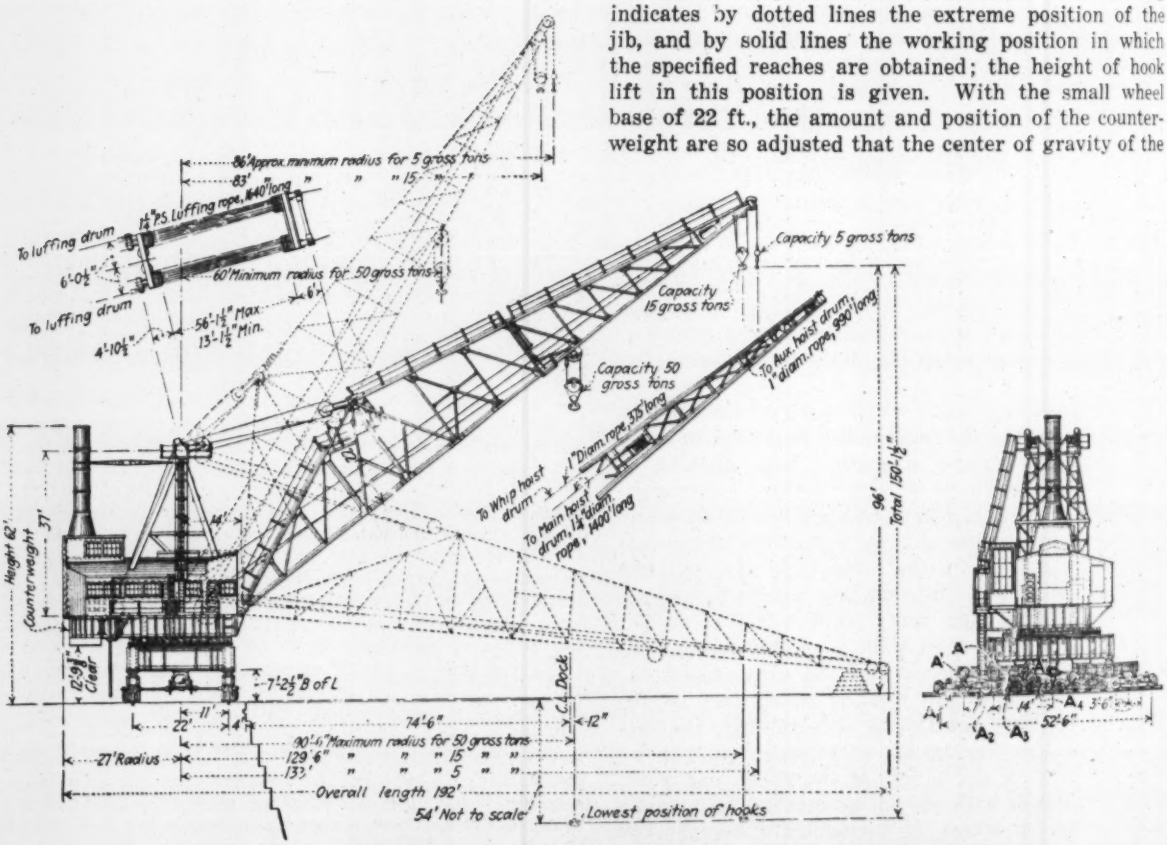


FIG. 2—EXTREME LOAD POSITIONS OF LARGE LUFFING-JIB CRANE

To provide for the great overturning moments on a wheel base only 22 ft. square, it was necessary to distribute the loads over thirty-two wheels. The crane must operate on a curve of 78½-ft. radius.

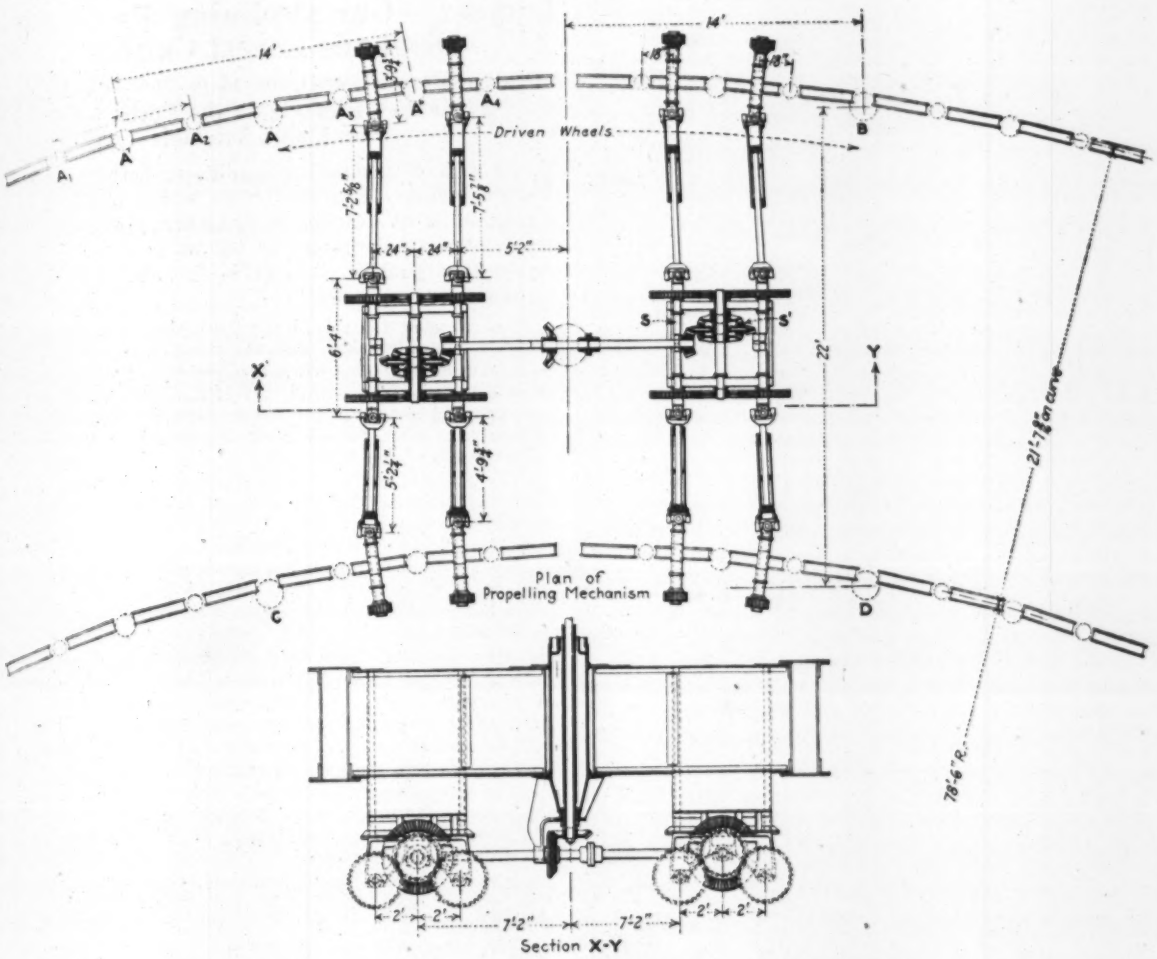


FIG. 3—FLEXIBLE PROPELLING DRIVE OF CRANE ON MAXIMUM CURVE

The thirty-two wheels are arranged in four groups, each group separately equalized. Positions of equalizer and truck pivots are shown by small circles between wheels. The eight inner wheels on each side, four of each group, are driven by the four transverse shafts through sliding sleeves and universal joints.

rotating superstructure remains within the roller circle under all load conditions, after taking account of a 5 per cent impact allowance and wind pressures of 30 lb. and 15 lb. for unloaded and loaded conditions respectively.

In designing the running gear of the crane, consideration had to be given to the fact that the dock was not designed and built to carry excessive concentrated loads, as well as to the fact that the track included a curve of 78½ ft. radius. These conditions called for a large number of wheels, to distribute the load over a considerable length of track.

In Fig. 3, a plan of the wheel arrangement, it is to be understood that the main carrying platform of the crane, a stiff plate-girder assemblage, is supported at its four corners by the main equalized pivots, A, B, C and D, as indicated in the elevation in Fig. 1. A main equalizer beam built of structural steel transfers the load of the corner to secondary pivots A′ and A″, from where subsidiary cast steel equalizers further distribute the load to truck hangers A_1, A_2, A_3, and A_4, respectively. By means of the two-wheel truck frames these hanger loads are each divided equally among two wheels. Thus the entire wheel support is freely adjustable laterally and vertical for either rail independently.

How the four driven wheels of each corner group shift from their tangent position when on curved track is indicated for one group by dash lines representing the normal position of these wheels. In order to transmit the propelling power to the wheels, the two cross shafts S and S′ have their end sections fitted with two universal joints and are furthermore made telescopic, the outer part being a sleeve which slides on the inner part (Fig. 4).

Power is supplied to this propulsion system by bevel gearing from a vertical shaft extending through the king pin of the rotating superstructure. A 12x12-in. reversing engine in the machinery house is geared to this vertical shaft. Swinging is provided for by a 9x10-in. reversing engine driving two vertical pinion shafts engaging a circular rack cast on the outer edge of the fixed turntable track segments. The other functions of the crane are taken care of by a 12x12-in. non-reversing engine and a 6x8-in. engine of the same type, the latter driving only the whip hoist. The main engine drives by two interlocked band friction clutches the main and auxiliary hoist drums, and by jaw clutch and worm gearing the two topping lift drums.

It should be noted that the crane turntable is carried by forty conical cast-steel rollers arranged as in swingbridge practice around the outside of a trussed structural steel ring girder and held to a central spider

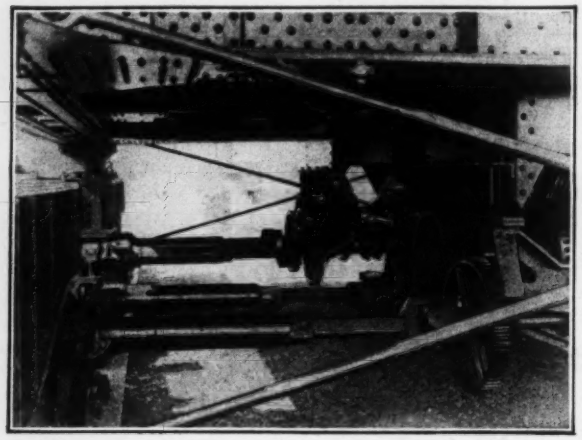


FIG. 4—SLIDING-SLEEVE DRIVE OF CARRIAGE

by independent radius rods. Under maximum working conditions, with full load assumed to be carried by ten rollers (one-fourth of the circle) under the front of the turntable, each roller carries a load of 84,000 lb. These rollers are 15 in. in outer diameter and 7½ in. wide on the face. The vertical equalizer pivots have roller thrust bearings, to minimize friction in rounding curves.

Since the Boston Navy Yard crane was built, a second machine of substantially identical construction has been built for the Puget Sound Navy Yard. According to reports received by the builders, the performance of both machines has been in all respects satisfactory, and in particular the operation of the flexible wheel base and the propelling system has met expectations fully.

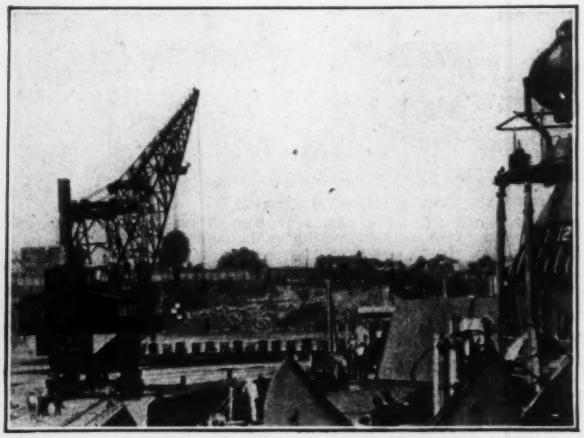


FIG. 5—CRANE ALONGSIDE DOCK

Bad Packing-Box Practice Causes Large Losses

In a recent address on research in the field of wood, C. A. Plaskett, of the Forest Products Laboratory, said, concerning the unsatisfactory state of the art in the field of packing boxes: "It is conservatively estimated that the economic loss to the industries of the United States due to poor packing, poor containers, unnecessary first cost, freight paid on containers which are too heavy or of two great volume, etc., is not less than $500,000 per day. If the methods of nailing boxes and reinforcing them with metal binding as recommended by the Forest Products Laboratory saves but one per cent of these losses, the saving would be over $1,800,000 a year."

Lumber—Our Declining Production Demands Forest Culture

Peak of Production Occurred in 1907—Center of Production Shifting to the Pacific—No New Fields Available

EVENTS of outstanding significance both to the lumber industry and the public which it serves are signalized in the statistics of two recent years of American lumbering, abstracted as follows in Department of Agriculture Bulletin No. 1119—"Lumber Cut of the United States, 1870-1920":

The first year was 1907, when the highest point in lumber production was reached, and the production curve started on a long, steep, downward slant, the end of which can not be determined. The second was 1920. The census of that year brought out three facts which are not only important but ominous when considered in relation to each other and to the events of preceding years.

1. Production continued to decrease in the face of an accumulated need for the use of lumber which is unparalleled.

2. The average value of lumber at the mills continued to rise to a point far above the high mark set in 1919. There was, in fact, an upheaval of lumber prices such as had never before been experienced, culminating in a peak which dwarfed the previous peaks, and followed by a decline as rapid as the rise. This spectacular event is of more than passing interest, both as an historical fact and as a symptom of economic stress. Yet in fundamental importance it is far surpassed by the third fact, namely that—

3. Lumber production increased in 11 Western states, but only one Eastern state cut more than in 1919. In the other 36 states production decreased. This is fresh evidence of the shift of the main center of lumber production from the southern pine belt to the West. It means not only that the great consuming centers of the East must haul a heavy percentage of their lumber twice as far as before, but also that we are now tapping our last reserve of virgin softwood forest.

This change comes at the end of 300 years of exploitation. It touches the welfare of every individual in our growing population. What does the future hold for us? What steps should be taken to meet national needs? The bare figures suggest questions of this kind but do not answer them. For that reason it is pertinent to discuss with the statistics of 1920 the related conditions in production, prices, and supply.

The production of lumber in 1920 was 33,800,000,000 ft.b.m., which is 2.2 per cent less than the production in the previous year. This, in itself, does not seem a great reduction. The feature of real meaning with regard to production is that 1920 shows one more slip downward, and that we have reached a point where the cut is 27 per cent less than the peak production which occurred in 1907. Figure 1 shows graphically the decline of the last 13 years. While it was not continuous, its trend is unmistakable and its amount notable. The average rate of reduction is 2 per cent per year.

This persistent decline in lumber production is the more worthy of attention because the population of the United States has increased by 15 per cent in the last decade. There now exists an amount of unsatisfied demand for construction unequaled at any previous period in our history. Normally, under such conditions, considerable increase would be expected. It is possible, of course, that with the increase of urban residence, under building restrictions, more brick, stone, steel, and concrete are being used for modern types of dwellings. It is also true that the best grades of the most desirable species are no longer so readily obtainable. The substitution of other materials is probably one reason for the decreasing use of wood by an increasing population. But there is at least one other cogent reason, and that is the steadily increasing cost of lumber to the consumer.

In spite of the fact that 60 per cent of the total cut of the country is made in the large and efficient plants

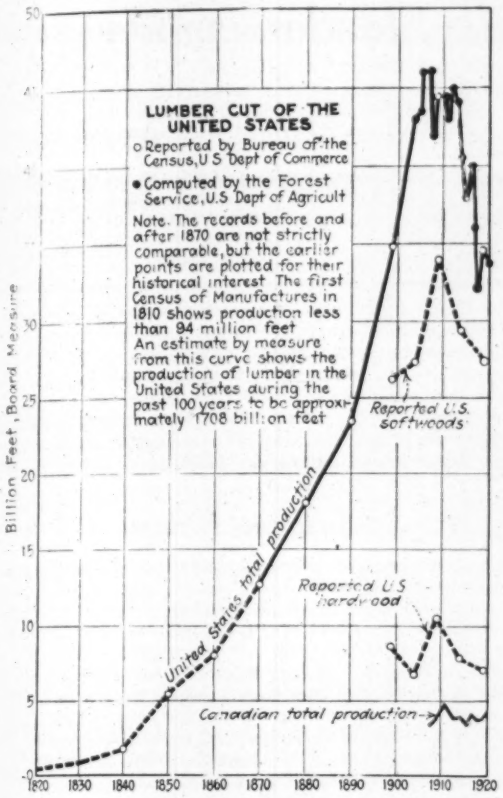

LUMBER CUT OF THE UNITED STATES
o Reported by Bureau of the Census, U S Dept of Commerce
• Computed by the Forest Service, U.S Dept of Agricult
Note. The records before and after 1870 are not strictly comparable, but the earlier points are plotted for their historical interest The first Census of Manufactures in 1810 shows production less than 94 million feet
An estimate by measure from this curve shows the production of lumber in the United States during the past 100 years to be approximately 1708 billion feet
Billion Feet, Board Measure
Reported U.S. softwoods
United States total production
Reported U.S hardwood
Canadian total production
0
5
10
15
20
25
30
40
50
1820
1830
1840
1850
1860
1870
1880
1890
1900
1910
1920

DIAGRAM SHOWING THE DECLINE IN PRODUCTION SINCE 1907

which have a capacity of 1,000,000 ft. of lumber a day, the average price of lumber at the mill in 1920 was $38.42 per thousand ft.b.m. This is an increase of $8.21 over 1919 and is the highest average ever recorded. This is largely due to the conditions which developed after the war and to the shifting of the center of production to the Pacific coast.

For 100 years the lumber industry has been in the process of migration from one forested region to another. The first lumbering took place along the Atlantic coast, from Maine southward to the Royal Colonies in Virginia and the Carolinas. But lumbering as we now know it did not get under full headway until nearly the middle of the last century, with the introduction of improved forms of machinery and large merchant mills. As the first cut of pine in the more thickly settled coast regions drew near its end the exploitation of the white pine forests of the Lake states began and the hardwood regions of the central Appalachians were opened to the market. As the cut of the Lake states drew to its close many lumber manufacturers of that region removed their operations to the South and began the attack upon the great belt of long-leaf pine stretching from Virginia to Texas. Each of these moves increased the distance between the centers of production and the centers of consumption. Now four-fifths of the original southern pine is gone, and there is in progress a marked drift of lumbermen from the Southern states to the Pacific coast, and to the northern part of the Rocky Mountains.

The most significant change resulting from the shift is the increased distance between the main center of production and the consuming centers of the country. Not quite 50 per cent of the lumber produced in the United States is consumed in the states north of Tennessee and east of Iowa. Heretofore the average haul of timber to this region has been between 500 and 1,000 miles. Hereafter a large amount of the supply will have to be hauled between 2,000 and 3,000 miles, although a considerable portion of the western timber may come by sea through the Panama Canal to the East coast markets. In the years when much more timber was accessible to water-borne traffic, transportation cost from $1 to $3 per thousand feet. In the year of this report it costs about $9 per thousand from the South and $20 from the Pacific coast to New York.

The seriousness of this situation is emphasized when we realize that the long step to the Pacific coast is the final shift in the migration of the lumber industry, unless Americans should desire to cross the Pacific in the search for new sources of lumber. The coast has the last large supply of North America, and the chances for securing softwoods elsewhere are not favorable, although the suggestion has repeatedly been made that once the native forests are exhausted we have only to purchase our lumber from other countries.

We must have huge quantities of softwood timber, the best of all woods for general purposes. The remaining pine, fir, spruce, and larch of the world are gathered in three great bodies. One is in northwestern America and Canada, another in Scandinavia and Finland, and the third in European and Asiatic Russia. There is little hope from Canada, for her so-called limitless forests are rapidly being developed to their capacity for the needs within the British Empire. The Alaskan forests are better adapted to pulpwood than to lumber.

The forests of Siberia are ringed about by the nations of Europe and Asia, some of which already have an eager eye upon this timber because it is essential to their participation in world trade. All of these nations are in greater actual need for timber than the United States.

It is practically certain that China, with her hundreds of millions, will develop industrially. Although for the present she imports from America, when ours is gone she will probably requisition great quantities of the Siberian timber.

Add to this the import demands of Japan and England, and the lesser requirements of Australia. Nearly 40 per cent of all human beings live within 2,500 miles of this timber, and even England, the most distant nation of those mentioned, is nearer to it than is Chicago.

Forest Culture—Obviously then it would be unwise to depend upon importation for any large part of our future lumber supply and forest culture in the United States is inevitable.

Price pressure will attend to that. Once our house is put in order, timber will no longer be the volunteer product of the public domain, but a crop, planted, tended, and cut as regularly as those of the farms. It may never again be as plentiful or as cheap as in the past, but after a while there will be enough, and perhaps some to spare for less fortunate countries. Thus, muddling through in Anglo-Saxon fashion, we shall finally bridge the gap between the pioneer methods of the past and scientific use of forest lands.

It is by no means a cheerless future that lies before us. On the contrary, it is full of promise—after the pinch is past. It means restoration instead of destruction. It means permanence of the lumber industry instead of sawmills wandering from end to end of the country. It means the steady flow of national wealth from the great areas now treeless which once nourished the magnificent forests of the past. It guarantees work as essential and constructive as that of the farmer, with steady wages for hundreds of thousands of men. For many it will prove an opening door of opportunity to get away from the cities and back to the land. The secondary industries which would spring up would provide work, wages, and prosperity for additional hundreds of thousands of skilled artisans.

The need is plain. With every passing year it becomes more urgent, for timber is the slowest of all crops to mature, and the mills are cutting four trees for every one restored.

The task is great. Yet the obstacles are not insurmountable. On the other hand, there is not much latitude of choice, for America must have timber, and the only way to get the amount needed is to grow it. Our timber supply and our wheat supply stand in the same category.

Progress in Water-Works Standardization

Abstracts of Fourteen Reports at Detroit Convention A.W.W.A.—Co-operation with N.E.W.W.A. on Meter Specifications, Meter Rate Slides and Statistical Report Forms, and with A.P.H.A. on Water Analysis Standards

Standard Contract Forms	Records and Reports	Colloid Chemistry and Water Treatment
Meter Specifications	Meter Rate Slides	Water Waste Control
Watershed Protection	Drinking Water Standards	Distribution Systems
Industrial Wastes	Standard Analysis Methods	Service Pipes
Cast-Iron Pipe	Purification Plant Loads	

The Standardization Council created two years ago with George W. Fuller as chairman has formed and is directing and co-ordinating the work of seventeen committees. Progress reports from a dozen of these committees were before the convention for discussion—either as printed in the May or earlier issues of the association's Journal, with revision or extension in the case of some of the earlier reports, or as more recent reports. Two committees of longer standing also presented reports: one on Standard Form of Contract and one on Meters, the last-named having acted jointly with a similar committee of the New England Water Works Association. Abstracts of technical papers and discussions at the A.W.W.A. convention appeared in our issue of May 31, p. 962. —EDITOR.

Standard Form of Contract

THROUGH J. Waldo Smith, chairman, and John M. Goodell, secretary, this committee asked tentative approval (which was given by those present) of a short Universal Contract Agreement and a longer set of Universal General Conditions (preprinted from *Journal* A.W.W.A., July, 1923) framed by the Joint Conference on Standard Construction Contracts which consists of representatives of the nine associations including the A.W.W.A., Am. Soc. C.E., A.I.A. and Assoc. Gen. Contrs. of America.

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Meter Specifications

THE association adopted the meter specifications already adopted by the N.E.W.W.A., these being the joint work of committees of the two bodies. F. A. Barbour, Boston, is chairman of the A.W.W.A. committee.

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Watershed Protection

THIS committee (W. L. Stevenson, chairman) presented again some topics for discussion which were submitted at the Philadelphia convention. (For the latest report see *Journal* A.W.W.A., May, 1923.) Particular attention was invited to the problems of relatively small watersheds "exposed to pollution, where filtration is not practiced but the conditions are such that moderately satisfactory water-supply" can be had if due care is given to watershed protection. The committee does not believe that it is often practicable to buy much or all of the land on this type of watershed; nor does it think the purchase of marginal strips about the reservoirs is of more than doubtful value in the majority of cases.

Discussion: In an extended discussion, Allen Hazen, New York, said that one reason for buying land in watersheds is to prevent future occupancy. Agreement with this was expressed by John Chester, Pittsburgh, and B. C. Little, Rochester. H. F. Ferguson, Springfield, Ill., said that in states like Illinois, where there are few natural reservoirs available for recreation, watershed control is of growing importance. In the Decatur district, the watershed has been zoned as to fishing, bathing, etc. The State Board of Health suggested that bathing be prohibited at any point nearer the water intake than ten miles but in view of local sentiment the district authorities cut this to 1½ miles against which the board made no objection since the matter is chiefly one of sentiment. C. A. Holmquist, Albany, N. Y., stated that the water-supplies of ninety-eight municipalities in New York State are protected by rules drawn by the State Health Department. George R. Taylor, Scranton, Pa., said that marginal purchases prevent trespass and discourage building near the reservoir.

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Industrial Wastes

PROF. Edward Bartow, Iowa City, Iowa, urged co-operation between state boards dealing with health, fish, etc., and manufacturers in the study of industrial wastes. J. N. Chester, Pittsburgh, and C. M. Saville, Hartford, outlined proposals made in their states for drastic legislation against industrial wastes and these and other speakers said that such extreme measures would kill industry and depopulate whole sections. (See *Journal* A.W.W.A., May, 1923, for reprint, with additions of lengthy report submitted in 1922; Almon L. Fales, chairman.)

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Revision of Standard Specifications for Cast-Iron Pipe and Specials

THIS report was devoted chiefly to Dr. Richard Moldenke's report to the Foundrymen's test bar committee. In 1916 the A.W.W.A. committee submitted a tentative draft of revised specifications which included chemical requirements of the metal. These requirements met with strong opposition from the manufacturers. The committee then turned its attention to "a progressive relation between deflection and load in test bars" and in 1922 proposed that 1 x 2 x 26-in. bar placed flatwise on supports 24 in. apart and tested transversely to destruction "shall develop a breaking load of not less than 1,900 lb. with a deflection at this load of not less than 0.3 in., while for bars breaking at higher loads there shall be an "additional deflection at the breaking point equivalent to 0.025 for each 200 lb. of breaking load above 1,900 lb." Under the existing A.W.W.A. specifications it is possible to run up the strength at the expense of the deflection.

The tests by Dr. Moldenke were financed by the foundry men. The first series of tests (made in 1921 and reported by the A.W.W.A. committee in 1922) showed that a large percentage of the iron from eight different foundries would have been condemned under the proposed specifications outlined above. The second or 1922 series of tests, made with a different cupola mix ("ordinary rich pig mixture") showed poorer results than the first set, the first set showing an average breaking load of 2,080 lb. and a deflection at breaking of 0.358, against 1,995 lb. and 0.301 for the second series, while in the second series less than half of the bars would have met the present 1,900-lb. load and 0.3-in. deflection requirement. Dr. Moldenke found that to enable 75 per cent of the bars tested by him to pass the deflection of 1,900 lb. load would have to be lowered to 0.22 in. "Your committee cannot accept this deflection as a reasonable basis for specifications." Furthermore "your committee is of the opinion that the irons tested by Dr. Moldenke are somewhat lower in average strength and

substantially lower in average deflection than those produced at the time the original specifications were written and for some years thereafter."

Some years ago T. H. Wiggin (a member of the A.W.W.A. committee) in work for the Metropolitan Water Board of Boston, found that the average breaking load for more than 3,500 test bars was 2,190 lb. and the average deflection 0.385. W. W. Brush, also a member of the committee, has for some years specified a deflection of 0.3 in. at 2,000 (as compared with the 1,900 lb. of the committee) and a flexure increment of 0.03 in. for each 200 lb. of additional breaking load.

In April, 1923, the manufacturers agreed to submit within six months a tentative draft of revised specifications based on that proposed by the A.W.W.A. committee in 1916. The American Engineering Standards Committee has recently taken up the task of standardizing cast-iron pipe. The chairman of the A.W.W.A. committee has accepted a place on the committee just named as a representative of the association.

Approval of the general stand taken by the committee was voiced by several who discussed the report. The chairman of the committee is F. A. Barbour, Boston.

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Standards for Satisfactory Drinking Water

THROUGH Abel Wolman this committee submitted for study and discussion the preliminary report of the bacteriological sub-committee of the Public Health Service's advisory committee (abstracted in *Engineering News-Record*, May 24, p. 929, in report of conference of State Sanitary Engineers).

Discussion: An extended discussion of the proposed new bacterial standard was opened by H. E. Jordan, sanitary engineer, Indianapolis Water Co., who is a member of the A.W.W.A. committee. He urged that the standard was too rigid, in proposing that not over 10 per cent of the tubes examined should show B. Coli., and suggested 20 per cent as a substitute. Mr. Jordan stated that the public water supplies of Boston, Providence, New York, Philadelphia, Cincinnati, Toledo and Milwaukee would not meet the 10 per cent limit; that these cities had an aggregate population of 9,500,000 in 1920; and that their 1922 typhoid death rates ranged from 3.8 for Toledo to 2.2 for New York, 1.4 for Boston and 0.0 for Providence. It was urged that these seven cities, whose water supplies could not be certified under the proposed standard, are protecting the health of their residents "if epidemiological evidence amounts to anything"; and that to make these waters ideal would require expenditures that would not produce results measurable by the typhoid death rates.

MacHarvey McCrady, Montreal, a member of the A.W.W.A. Committee, said he would not wish to accept a bacterial standard until the field survey, chemical and physical standards were before him. C. A. Emerson, Jr., Philadelphia, said that while the bacterial standard is only one of four proposed yet it is now being put out definitely. When the Treasury standard was first put out it was to govern railway water supplies only but it was seized upon for municipal supplies and has been accepted by the courts. The sub-committee feared that if 20 per cent were the limit short lapses would be allowed, so proposed two classes, one for a larger and one for a smaller number of samples. Why not adapt the 20 per cent limit proposed by Mr. Jordan? Lyle L. Jenne, sanitary engineer, Philadelphia Bureau of Water, felt that every city would wish to attain each of the four standards—bacterial, field survey, chemical and physical. The number of typhoid cases in Philadelphia in different parts of the year is in inverse ratio to the number of B. Coli in the water. He favored the 20 per cent limit.

E. Sherman Chase, of Metcalf & Eddy, Boston, after reviewing some B. Coli and typhoid statistics, concluded there was no relation between the two. C. M. Baker, Madison, Wis., asked whether the same bacterial standard should be used for all classes of sources of supply and urged the use of common sense in applying standards. W. W. Brush, New York, thought the proposed standard should be broadened in its application. Dr. Frank E. Hale, New York City, considered the proposed standard too high. N. J. Howard, Toronto (a member of the A.W.W.A. Committee), said that the discussion showed no relation between coli and typhoid. So high a standard as is proposed may result in heavy chlorination, bad tastes, and the use of other than the public water supply.

In closing the discussion, Abel Wolman stated that the sub-committee did not base its recommendation on typhoid figures and has no data for correlating B. Coli and typhoid. B. Coli was adopted as affording the best available evidence of the presence of fæces in water. The cities which Mr. Jordan cites do not meet the old standard, he said. Replying to some interjected remarks by two or three speakers to the effect that those who had spoken against the new standard did not represent the consensus of opinion, Mr. Wolman said that perhaps he had been lax in not rallying favorable opinion for the standard as effectively as Mr. Jordan had unfavorable.

* * *

Essential Data for Water Records and Reports

FOR the sub-division on municipally-owned works, George H. Fenkell, Detroit, reported a form much like that of the N.E.W.W.A., and stated that his committee is working with one from the N.E.W.W.A. J. N. Chester, for the sub-division on privately-owned works, raised a point as to the two sub-divisions which led George W. Fuller, chairman of the Standardization Council, to state that the two sub-divisions should agree on general principles, then work out details to suit the two classes of ownership. This was agreed to.

* * *

Quantities for Slides in Meter Schedules

ALLEN Hazen, chairman, submitted and the association adopted a standard quantity-slide plan on which to base meter rates, the rates being left to local determination. Except for method of statement and the offering of a fourth quantity for use if desired in cities having very large consumers, the slides are the same as those adopted by the N.E.W.W.A. in 1916. (See preliminary report, *Journal* A.W.W.A., July, 1922, for review of the N.E. scheme.) The original three slides (on the monthly basis) were (1) for all water consumed up to 25,000 gal.; (2) for the next 225,000; (3) for the next 2,250,000 gal. The fourth slide covers all water consumed above 2,500,000 gal. a month. Where bills are sent out quarterly or yearly the slide quantities are increased accordingly. In all cases the payments for water consumed are to be in addition to the service charge based on the size of the meter.

The unit prices at each step in the slide are left to be fixed for each city, but with the following general recommendation: That wherever possible fractions of cents be not used; that the intermediate price (on the original three-slide plan) be to the nearest cent half way between the (1) and (3) rate. In other words, consideration should be centered on the domestic and the manufacturing rates. A ratio between the rates for (1) and (3) of about 2 to 1 is suggested and between (1) and (4) of 3 to 1.

In the case of municipal plants where the costs of water mains, services and meters and the repairs of services and meters are charged against the consumers a single rate per 1,000 gal. may be satisfactory (i.e., no slide). The service charge seems to be the point on which public opposition has centered.

The standard slide has been adopted by sixteen cities and companies, applicable to a total population of more than 3,000,000. Among the cities is Detroit, Mich., where the standard will go into effect July 1.

Discussion: J. N. Chester said he had sixteen communities to add to those reported by Mr. Hazen.

Standard Methods of Water Analysis

THE part of this report of greatest general interest as brought out by its chairman, Jack Hinman, Iowa City, Iowa, and emphasized also by Mr. Fuller, is that following advances by a similar committee of the A.P.H.A. the two committees have agreed to join forces in revising and publishing the "Standard Methods of Water Analysis" adopted years ago by the A.P.H.A. and revised from time to time by its committees.

* * *

Practicable Loading for Purification Processes

EXTENSIVE data gathered by members of the committee (E. E. Wall, St. Louis, chairman) were submitted as a progress report (see *Journal* A.W.W.A., May, 1923) but as yet the committee is not ready to draw conclusions.

* * *

Colloid Chemistry Water and Purification

THE value of the hydrogen-ion method of control varies greatly with the kind of water. It seems more applicable to water of low than of high alkalinity and is useful in determining whether to use an acid alum for coagulation and in adjusting the rate of chlorination. R. S. Weston, Boston, is chairman of this committee.

* * *

Water-Waste Control

THROUGH its chairman, W. W. Brush, New York City, a lengthy report was presented (see *Journal* A.W.W.A., May, 1923). The fact that one city has as low or a lower rate of consumption than another means nothing. The proper comparisons are between night and day rates, district rates, domestic and industrial rates. Water wasted is water not drawn to serve a useful and legitimate purpose. Water unaccounted for is that part of the water flowing into the distribution system which is not delivered to the consumers. Water slippage should be separately reported. Data on the proper size of taps are few. It would seem that ⅝- or ¾-in. taps might be adopted as the minimum size. A fairly liberal size of taps and services and a cutting down on meter sizes is suggested, since a large meter can be substituted readily while a larger service and tap cannot.

Discussion: Edward S. Cole, New York, urged the importance of recording the volume of water supplied to large customers. This is generally a simple matter. Frequently the larger meter accounts are kept in a separate ledger. Charles S. Foreman, Kansas City, Mo., reported a classification of metered accounts into manufacturing, commercial and residential. Water consumption and revenue are run off on the same adding machine.

The proper sizes of services and meters and the relation thereto of flushometer closets were discussed at length. Mr. Foreman said these depend on pressure and other local conditions. At Terre Haute, Ind., said Dow R. Gwinn, with 45 lb. pressure in the residence district and for an eight-room house, a ¾-in. tap and service gives good results. C. M. Saville, Hartford, said that the advent of flushometer closets calls for larger meters. He has given up arguing that larger meters increase the amount of unrecorded water since he ran parallel tests of ⅝-, ¾- and 1-in. meters of four different makes and found all within the specification limits of accuracy. John N. Chester, Pittsburgh, Pa., declared himself as becoming an advocate of larger services and meters. If there is a graduated service charge and a minimum meter rate he would let the consumer have whatever size of service and meter he wants, but he realized that this matter is a special problem in some cities.

Aquaphones for detecting leaks are the best available device in noisy Manhattan, said W. W. Brush, New York. The electric leak detector has been found useful in locating known leaks at Windsor, Ont., reported D. McLean Hanna, but it can be used only where quiet prevails; even rain will prevent its use.

Physical Standards for Distribution Systems

THIS committee (through L. Chevis, St. Louis, Mo., in the absence of G. Gale Dixon, chairman) submitted three new items of terminology (in addition to those printed in *Journal* A.W.W.A., January, 1923). Distribution rather than equalizing or service reservoir was advised; zone is defined as an area situated between certain approximate elevations served by an independent portion of the distribution system (adapted from Turneaure and Russell's "Public Water Supplies,") and the several zones should be numbered from lowest to highest, preferably by districts; relay pumps are those that lift water from one zone to another.

* * *

Standardization of Services

A QUESTIONNAIRE will be necessary before a report can be formulated, reported John Diven, chairman of this committee.

Reproduction-New Theory of Value Upheld By Supreme Court

Rule Laid Down by Justice Harlan in Smyth-Ames Case Confirmed by Majority With Justices Brandeis and Holmes Dissenting

IN AN IMPORTANT decision handed down on May 21 the United States Supreme Court reaffirmed the famous Smyth-Ames decision of Justice Harlan that present value is the proper basis for public utility rate-making. The decision is equally important because of the extended criticism of that ruling by Justice Brandeis, concurred in by Justice Holmes.

The court reversed the Supreme Court of Missouri which had upheld an order of the Missouri Public Service Commission directing the Southwestern Bell Telephone Co. to reduce its rates. Justice McReynolds, in delivering the opinion said:

From the evidence submitted it was obvious that the commission undertook to value the property without according any weight to the greatly enhanced costs of material, labor, supplies, etc., over those prevailing in 1913, 1914 and 1916. As a matter of common knowledge, these increases were large. Competent witnesses estimated them as 45 to 50 per centum.

In *Wilcox v. Consolidated Gas Co.*, this court said, "There must be a fair return upon the reasonable value of the property at the time it is being used for the public. . . . And we concur with the court below in holding that the value of the property is to be determined as of the time when the inquiry is made regarding the rates. If the property, which legally enters into the consideration of the question of rates, has increased in value since it was acquired, the company is entitled to the benefit of such increase." In *The Minnesota Rate Cases*, this was said, "The making of a just return for the use of the property involves the recognition of its fair value if it be more than its cost. The property is held in private ownership and it is that property, and not the original cost of it, of which the owner may not be deprived without due process of law."

It is impossible to ascertain what will amount to a fair return upon properties devoted to public service without giving consideration to the cost of labor, supplies, etc., at the time the investigation is made. An honest and intelligent forecast of probable future values made upon a view of all the relevant circumstances, is essential. If the highly important element of present costs is wholly disregarded such a forecast becomes impossible. Estimates for tomorrow cannot ignore prices of today.

Witnesses for the company asserted—and there was no substantial evidence to the contrary—that excluding cost

of establishing the business the property was worth at least 25 per cent more than the commission's estimates, and we think the proofs show that for the purposes of the present case the valuation should be at least $25,000,000.

After disallowing an actual expenditure and some other items not presently important, the commission estimated the annual net profits on operation available for depreciation and return as $2,828,617.60—approximately 11⅓ per cent of $25,000,000. That 6 per cent should be allowed for depreciation appears to be accepted by the commission. Deducting this would leave a possible 5⅓ per cent return upon the minimum value of the property, which is wholly inadequate considering the character of the investment and interest rates then prevailing. . . . It must never be forgotten that while the state may regulate with a view to enforcing reasonable rates and charges, it is not the owner of the property of public utility companies and is not clothed with the general power of management incident to ownership.

The Minority Opinion—The court was unanimous as to the reversal but Justice Brandeis, with whom Justice Holmes concurred, filed a minority opinion as follows:

I concur in the judgment of reversal. But I do so on the ground that the order of the state commission prevents the utility from earning a fair return on the amount prudently invested in it. Thus, I differ fundamentally from my brethren concerning the rule to be applied in determining whether a prescribed rate is confiscatory. The court, adhering to the so-called rule of *Smyth v. Ames*, and further defining it, declares that what is termed value must be ascertained by giving weight, among other things, to estimates of what it would cost to reproduce the property at the time of the rate hearing.

The so-called rule of *Smyth v. Ames* is, in my opinion, legally and economically unsound. The thing devoted by the investor to the public use is not specific property, tangible and intangible, but capital embarked in the enterprise. Upon the capital so invested the federal Constitution guarantees to the utility the opportunity to earn a fair return. Thus, it sets the limit to the power of the state to regulate rates. The Constitution does not guarantee to the utility the opportunity to earn a return on the value of all items of property used by the utility, or of any of them. The several items of property constituting the utility taken singly, and freed from the public use, may conceivably have an aggregate value greater than if the items are used in combination. The owner is at liberty, in the absence of controlling statutory provision, to withdraw his property from the public service, and, if he does so, may obtain for it exchange value. But so long as the specific items of property are employed by the utility, their exchange value is not of legal significance.

The investor agrees, by embarking capital in a utility, that its charges to the public shall be reasonable. His company is the substitute for the state in the performance of the public service; thus becoming a public servant. The compensation which the Constitution guarantees an opportunity to earn is the reasonable cost of conducting the business. Cost includes not only operating expenses, but also capital charges. Capital charges cover the allowance, by way of interest, for use of the capital, whatever the nature of the security issued therefor; the allowance for risk incurred; and enough more to attract capital. The reasonable rate to be prescribed by a commission may allow an efficiently managed utility much more. But a rate is constitutionally compensatory, if it allows to the utility the opportunity to earn the cost of the service as thus defined.

To decide whether a proposed rate is confiscatory, the tribunal must determine both what sum would be earned under it, and whether that sum would be a fair return. The decision involves ordinarily the making of four subsidiary ones:

1. What the gross earnings from operating the utility under the rate in controversy would be. (A prediction.)

2. What the operating expenses and charges, while so operating, would be. (A prediction.)

3. The rate-base, that is, what the amount is on which a return should be earned. (Under *Smyth v. Ames*, an opinion, largely.)

4. What rate of return should be deemed fair. (An opinion, largely.)

A decision that a rate is confiscatory (or compensatory) is thus the resultant of four subsidiary determinations. Each of the four involves forming a judgment, as distinguished from ascertaining facts. And as to each factor, there is usually room for difference of judgment. The first two factors do not ordinarily present serious difficulties. But doubts and uncertainties incident to prophecy, which affect them, can, often, be resolved by a test period; and meanwhile protection may be afforded by giving a bond.

The doubts and uncertainties incident to the last two factors can be eliminated, or lessened, only by redefining the rate-base, called value, and the measure of fairness in return, now applied under the rule of *Smyth v. Ames*. The experience of the twenty-five years since the case was decided has demonstrated that the rule there enunciated is delusive. In the attempt to apply it insuperable obstacles have been encountered. It has failed to afford adequate protection either to capital or to the public. It leaves open the door to grave injustice. To give to capital embarked in public utilities the protection guaranteed by the Constitution, and to secure for the public reasonable rates, it is essential that the rate-base be definite, stable, and readily ascertainable; and that the percentage to be earned on the rate-base be measured by the cost, or charge, of the capital employed in the enterprise. It is consistent with the federal Constitution for this court now to lay down a rule which will establish such a rate-base and such a measure of the rate of return deemed fair. In my opinion, it should do so.

The rule of *Smyth v. Ames* sets the laborious and baffling task of finding the present value of the utility. It is impossible to find an exchange value for a utility, since utilities, unlike merchandise or land, are not commonly bought and sold in the market. Nor can the present value of the utility be determined by capitalizing its net earnings, since the earnings are determined, in large measure, by the rate which the company will be permitted to charge; and thus, the vicious circle would be encountered.

. . . . . .

There is another potent reason why, under the rule of *Smyth v. Ames*, the room for difference in opinion as to the present value of a utility is so wide. The rule does not measure the present value either by what the utility cost to produce; or by what it should have cost; or by what it would cost to reproduce, or to replace it. Under that rule the tribunal is directed, in forming its judgment, to take into consideration all those and also, other elements, called relevant facts.

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Many commissions, like that of Massachusetts, have declared recently that "capital honestly and prudently invested must, under normal conditions, be taken as the controlling factor in fixing the basis for computing fair and reasonable rates."

To require that reproduction cost at the date of the rate hearing be given weight in fixing the rate-base, may subject investors to heavy losses when the high war and post-war price levels pass—and the price trend is again downward. The aggregate of the investments which have already been made at high costs since 1914, and of those which will be made before prices and costs can fall heavily, may soon exceed by far the depreciated value of all the public utility investments made theretofore at relatively low cost. For it must be borne in mind that depreciation is an annual charge. That accrued on plants constructed in the long years prior to 1914 is much larger than that accruing on the properties installed in the shorter period since.

That part of the rule of *Smyth v. Ames* which fixes the rate of return deemed fair, at the percentage customarily

paid on similar investments, at the time of the rate hearing also exposes the investor and public to danger of serious injustice. If the replacement-cost measure of value and the prevailing-rate measure of fairness of return should be applied, a company which in 1920 for additions to plant raised $1,000,000 on a 9 per cent basis, by a stock issue or by long-term bond issue, may find a decade later that the value of the plant (disregarding depreciation) is only $600,000, and that the fair return on money then invested in such enterprise is only 6 per cent. Under the test of a compensatory rate, urged in reliance upon *Smyth v. Ames*, a prescribed rate would not be confiscatory, if it appeared that the utility could earn under it $36,000 a year; whereas $90,000 would be required to earn the capital charges. On the other hand, if a plant had been built in times of low costs, at $1,000,000, and the capital had been raised to the extent of $750,000 by an issue at par of 5 per cent 30-year bonds and to the extent of $250,000 by stock at par, and ten years later the price level was 75 per cent higher and the interest rates 8 per cent, it would be a fantastic result to hold that a rate was confiscatory, unless it yielded 8 per cent on the then reproduction cost of $1,750,000. For that would yield an income of $140,000 which would give the bondholders $37,500; and to the holders of the $250,000 stock $102,500, a return of 41 per cent per annum. Money required to establish in 1920 many necessary plants has cost the utility 10 per cent on 30-year bonds. These long-time securities, issued to raise needed capital, will in 1930 and thereafter continue to bear the extra high rates of interest, which it was necessary to offer in 1920 in order to secure the required capital. The prevailing rate for such investments may in 1930 be only 7 per cent, or indeed 6 per cent.

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In essence, there is no difference between the capital charge and operating expenses, depreciation and taxes. Each is a part of the current cost of supplying the service; and each should be met from current income. When the capital charges are for interest on the floating debt paid at the current rate, this is readily seen. But it is no less true of a legal obligation to pay interest on long-term bonds, entered into years before the rate hearing and to continue for years thereafter; and it is true also of the economic obligation to pay dividends on stock, preferred or common.

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Where the financing has been proper, the cost to the utility of the capital, required to construct, equip and operate its plant, should measure the rate of return which the Constitution guarantees opportunity to earn.

The adoption of the amount prudently invested as the rate-base and the amount of the capital charge as the measure of the rate of return would give definiteness to these two factors involved in rate controversies which are now shifting and treacherous, and which render the proceedings peculiarly burdensome and largely futile. Such measures offer a basis for decision which is certain and stable. The rate-base would be ascertained as a fact, not determined as matter of opinion. It would not fluctuate with the market price of labor, or materials, or money. It would not change with hard times or shifting populations. It would not be distorted by the fickle and varying judgments of appraisers, commissions, or courts. It would, when once made in respect to any utility, be fixed, for all time, subject only to increases to represent additions to plant, after allowance for the depreciation included in the annual operating charges. The wild uncertainties of the present method of fixing the rate-base under the so-called rule of *Smyth v. Ames* would be avoided; and likewise the fluctuations which introduce into the enterprise unnecessary elements of speculation, create useless expense, and impose upon the public a heavy, unnecessary burden.

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What is now termed the prudent investment is, in essence, the same thing as that which the court has always sought to protect in using the term present value. Twenty-five years ago, when *Smyth v. Ames* was decided, it was impossible to ascertain with accuracy, in respect to most of the utilities, in most of the states in which rate controversies arose, what it cost in money to establish the utility; or what the money cost with which the utility was established; or what income had been earned by it; or how the income had been expended. It was, therefore, not feasible, then, to adopt, as the rate basis, the amount properly invested or, as the rate of fair return, the amount of capital charge. Now the situation is fundamentally different. These amounts are, now, readily ascertainable in respect to a large, and rapidly increasing, proportion of the utilities.

. . . . . .

The amount and disposition of current earnings of all the companies are also known. It is, therefore, feasible now to adopt—as the measure of a compensatory rate—the annual cost, or charge, of the capital prudently invested in the utility. And, hence, it should be done.

Value is a word of many meanings. That with which commissions and courts in these proceedings are concerned, in so-called confiscation cases, is a special value for rate-making purposes, not exchange value.

. . . . . .

The rule by which the utilities are seeking to measure the return is, in essence, reproduction-cost of the utility or prudent investment, whichever is the higher. This is indicated by the instructions contained in the Special Report on Valuation of Public Utilities, made to the American Society of Civil Engineers, October 28, 1916, Proceedings, Vol. 42:

"So long as the company owner keeps a sum equivalent to the total investment at work for the public, either as property serving the public, or funds held in reserve for such property, no policy should be followed in estimating depreciation that will reduce the property to a value less than the investment . . ." (p. 1726).

"Estimates of the cost of reproduction should be based on the assumption that the identical property is to be reproduced, rather than a substitute property" (p. 1719). . . . "although such a substitute property, much less costly than the existing plant, might furnish equal or better service, it is not reproduction of service, but of property, that is under consideration; and clearly the estimate should be of existing property created with public approval, rather than of a substituted property" (p. 1772).

If the aim were to ascertain the value (in its ordinary sense) of the utility property, the inquiry would be, not what it would cost to reproduce the identical property, but what it would cost to establish a plant which could render the service, or in other words, at what cost could an equally efficient substitute be then produced. Surely the cost of an equally efficient substitute must be the maximum of the rate-base, if prudent investment be rejected as the measure. The utilities seem to claim that the constitutional protection against confiscation guarantees them a return both upon unearned increment and upon the cost of property rendered valueless by obsolescence.

Track Elevation at Indianapolis

At the last session of the Indiana legislature a new track elevation law was passed which gives the city of Indianapolis authority to order track elevation work and to carry it out where the railroad companies are financially unable to do the work, charging the cost 50 per cent against the city and 50 per cent against the companies. This law was necessary as the next large project is the separation of grades on the Indianapolis Union Belt R.R., which circles three sides of the city. As this railroad has been put to heavy expense on the track elevation through the union station and downtown district, which is approximately finished, it could not afford additional work on the present basis of the company paying 75 per cent and the city 25 per cent. Plans are now being made by the city.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

How Can We Stop Duplication of Orders?

Sir—We are in accord with your editorial, "How Can We Stop Duplication of Orders." Too many contracts are made between manufacturers and contractors which mean very little, if anything. Contracts should be drawn more specifically and there should be penalties on both sides if the contract is not properly fulfilled. It sometimes happens, however, that a general contractor will secure a contract and make his purchase in good faith, and the project may then be suspended, in which case we feel that there should be some recourse for the contractor as long as he dealt sincerely. We are also of the opinion that the contractor should be reimbursed if the manufacturer does not deliver his goods at the time specified.

We hope that through your influence some good will come and that the duplication of orders may be abolished. Yours for more stable conditions in the building industry.

HENRY W. HORST CO., General Contractors,
Rock Island, Ill., May 25. By A. E. Horst.

Sir—The editorial in the *Engineering News-Record* of April 26 is first-class both in form and substance. The practice of duplication of orders for construction materials came up for discussion at a board meeting of the Associated General Contractors of America on May 14 in New York City. I had not known of the practice before that time, and while some of the members of the Board knew of it, it developed that not one member of the board present had indulged in the practice. The duplicating of orders should, of course, be stopped, and the way to stop it is that outlined in the editorial.

Minneapolis, May 25. W. O. WINSTON,
Chairman Board of Directors,
Winston Bros. Co., Constructors.

The International Railway

Sir—Your recent article on the Pan-American Railway or the International Railway, as South Americans prefer to call it, has undoubtedly been read with great interest by all those who have the intelligent development of South America at heart.

Practically no one expects that such a project would at the present time be considered financially feasible as a complete undertaking. It is recognized, however, as being a very sensible general plan which is rapidly attracting the attention of most all governments who might be served thereby. The extension of the Argentine railways to Santa Cruz de la Sierra is a very live project. The same is true of the extension of the Bolivian Railways from Cochabamba to Santa Cruz and hardly six months have passed since the last studies were made of the route from Corumbá, Brazil to Santa Cruz. Tremendous interests are involved in these three parts of the southern end of the line, parts which total nearly 1,000 miles. Very careful reconnaissance has been made for perhaps another 1,000 miles to the north. Large tracts of land have been purchased by well informed investors and it is toward this northern section that construction work on the Yungas lines in Bolivia has been done.

Certainly reconnaissance, nor investments in land, does not imply prompt construction. The purchase by well informed investors does, however, imply a sense of security that a line will ultimately be built in that general zone.

A great difficulty in the maintenance of interest in the so-called Pan-American Railway over a period of a quarter of a century, has been the general recognition of the improper location first proposed. For many years persons discussing this problem seemed to feel that the location had been finally determined along the back bone of the Andes Unfortunately, some people with sound arguments against the original line complain about any project under that name. Very few thinking people ever imagined that 4,000 miles of railway might be built merely because it would be a link in the Pan-American Railway. The railway as indicated generally by Mr. Morris will undoubtedly be built because it is of political and economic importance to every country along the route to do so. Mr. Morris' plan is more of a resumé of what is in the minds of thinking men in South America who have more or less authority, than a carelessly thrown together scheme. No doubt he will be accused of dreaming but he is a very well informed engineer with years of South American railway experience behind him and the dreams of such men oftimes come true. You have done at least one thing in this article and that is to merely show by comparison, to those who know the problem, the utter futility of ever expecting a railway line of any importance along the back bone of the Ecuadorian Andes.

New York, V. L. HAVENS,
June 2, 1923. Editor, *Ingeneria Internacional.*

Sir—The article appearing in your issue of May 10, 1923, p. 837, entitled "Propose Restudy of Pan-American Railway Project" leaves the impression that the alternative route called "South American International R.R." is far superior to the original line of the "Intercontinental Ry." located at the close of the nineteenth century and generally known as the "Pan-American Ry."

I had the opportunity to make a thorough study of the original route and came to the conclusion that it is by far the most suitable location, which opinion was fully corroborated by my experiences in the affected countries, where I was engaged on various railroad projects.

The merits of the old location become more apparent by comparing both lines, especially as far as the territory served is concerned.

Particularly open to the criticism is the section of the "South American International R.R." passing through Ecuador, Peru, Brazil and Bolivia. The major portion of this district is a virgin jungle having a hot and damp climate with evidence of fever; besides this whole region represents the most sparsely populated zone in South America inhabited principally by savage Indian tribes.

The only points worth mentioning along the central section of the alternative route are Iquitos in Peru (population 12,000), Cruzeiro do Sul in Brazil (5,000), and in Bolivia the cities of Trinidad (6,000) and Santa Cruz (30,000). There is a provision to connect the upland centers of Ecuador and of Peru by lengthy branches but judging by the usual rate of progress these important facilities will not be available for several decades to come.

Even after the delayed completion of the proposed branches—what a runabout way from Buenos Aires to La Paz, to Lima and to Quito along the "South American International R.R." As an example, the distance between Buenos Aires and Lima would be approximately 1,300 mi. longer than the same route along the original "Pan-American Ry."

However, it must be admitted that the central portion of the alternative route passes through a district of tremendous future possibilities. It is essentially a rubber country with excellent opportunities for cultivation of cacao, coffee, sugar cane, tobacco and other tropical products and with an indication of mineral wealth. But judging from my experience the developing of this rich zone will be very slow. The main problem is the absolute lack of labor. It is aggravated by the long distance and the quality of the nearest labor market. The Quechua Indian from the western Andean uplands is the nearest labor element available but from previous experiences these workers do not like to work in lowlands even for increased wages, which by the way are already much higher than those of the laborers employed in rubber plantations of the Amazon basis.

Another very important feature of the problem is the competition of the waterway transportation. Without doubt the increased production of this zone will bring into

existence many new steamship lines and the subsequent competition between all water routes on account of the volume of traffic and low operating expenses will cut the present high water transportation rates below those of the proposed "South American International R.R.," in which case this railroad would carry only insignificant traffic between adjacent river ports. Of course there is a possibility that after many years the volume of business is bound to increase to such an extent that the railroad in question could cut the through rates and successfully compete with the water transportation.

As far as horizontal and vertical alignment is concerned it must be admitted that the alternative route, thanks to the topography, has an advantage over the original line. But the steep grades on the old location do not represent any economic handicap when we consider the fact that the sections of the "Pan-American Railway" already built have very steep gradients yet are showing a satisfactory revenue from operation.

At present almost 50 per cent of the "Pan-American Ry." is built, leaving approximately 2,700 mi. to be completed. On the other hand about 3,500 mi. must be constructed of the "South American International R.R."—and including all the necessary connections to Lima and to Quito this distance increases to almost 5,000 mi. About 1,500 mi. of this larger mileage represents difficult construction equally as costly as that of the "Pan-American Ry." By simple deduction it is apparent that it will be impossible to build the remaining 3,500 mi. of the alternative route representing easier construction at the same cost as the rest of 1,200 mi. of the original line.

The summary of the above should be enough to convince anyone that the "South American International R.R." should not be constructed as a substitute of the original "Pan-American Ry." The excessive construction cost, the unsuitable territory traversed and the absence of any revenue for a long period of years are the main arguments against it.

The economic railroad program for South America should be as follows:

(1) To complete the original "Pan-American Ry." as soon as possible.

(2) To connect this system with the eastern lowlands by branches crossing the Andes, and to develop these districts intensively.

(3) After many years, when the conditions warrant it, to build a trunk line along the route of the proposed "South American International R.R.".

J. A. LENECEK,
New York, May 24, 1923. Erie R.R. Co.

Decentralization and the Association's Experience

Sir—Referring to your editorial of May 17, p. 859, entitled "A Turning Point," and the report of the American Association of Engineers convention on p. 888, I wish to comment on a few of the points which you have brought out.

The Association, as you have pointed out, made a radical departure and attempted a difficult experiment two years ago, in this acting against the advice of many of its friends and going contrary to the experience of similar organizations. It was in effect an almost hysterical plunge, not clearly thought out in advance, but initiated and carried through by men who were impatient of the progress made and believed that a short cut to success could be found. Perhaps it is as well for engineers in general and for all similar organizations throughout the country that the experiment was made, if others are saved from repeating the error. Everything possible was done to insure success, but in vain. Practically everyone who has studied the methods and results is now convinced that the principle is wrong and that a strong organization cannot be created and maintained along the lines of decentralization then adopted.

The theory was that the local chapters had developed (or could be developed) to a point where they could carry on the work of the Association more effectively than the central organization. A few chapters have succeeded, but the fact remains that without the continual inspiration and support from headquarters the ordinary chapter quickly loses interest, uses time and money on personal or trivial details, and loses sight of the great objectives. The result is such as might be attained if each company or battalion of an army should be left to itself to carry out the plan of attack; or if each selling agency of a big corporation were left to develop its own business methods. In short, the experiment begun two years ago swung the organization from the path of onward, effective progress, accompanied by rapid growth, to a weak and irresolute decentralization, with rapid loss of membership.

It is to be noted that this loss of membership was accentuated by the economic conditions of the country but the loss would not have been as great if the board of directors and committees at headquarters had possessed influence and authority such as they had during the previous years.

Now that the experiment has been fairly tried and the results are apparent, the lesson taught should be made of value. The board of directors, to whom is entrusted the immediate future of the organization, should take advantage of this bitter experience. Having seen how near the organization has been to the edge of the precipice they can and should so direct affairs as to keep away from similar danger in the future, and return to methods which have proved successful in this and other organizations. They must take a stronger and more constructive hand in affairs, and try to impress on individual chapters their ability and duty to carry out the large ideals of service to the members.

"Money is the root of all evil." Or, more nearly applicable to present conditions, the inability or unwillingness to plan and use wisely the money made available to the chapters has brought about the downfall of many of them, and has resulted in conditions little short of scandalous.

One of the objectives of the chapter organization of engineers has been that of making these chapters capable of giving something comparable to a post-graduate education to young engineers—notably in the matter of public relations, and in financial affairs. Experience has shown that there is great need of such education. The disappointment of the past two years may be turned to good account if the membership can be aroused to an appreciation of the need of handling financial affairs in a more effective manner. To do this, the membership must have a larger appreciation of the fact that financial integrity is as important as technical ability, and that lack of such integrity comes more largely from ignorance and carelessness than from moral defect.

One of the points that should be brought out is that every dollar collected in the name of the American Association of Engineers must be effectively devoted to the purposes of the organization; this purpose can be determined only by the board of directors. Money apportioned to any chapter belongs to the organization, and there is a moral as well as legal obligation on the part of that chapter's officers to devote this money to the purposes stated in the constitution, and approved by the elected officers of the national body. Nothing, perhaps, caused a deeper feeling of sorrow than to learn that some of the chapters had utilized the funds raised for these large purposes for personal or trivial ends, with a disregard of larger moral obligations. There is no doubt that this was done in ignorance, but it has aroused a question as to whether the decentralized association has been effective in maintaining a high standard of integrity in money matters, at least among engineers. This is a question which may be asked of all organizations of this kind made up of professional men who have not had consistently inculcated the fundamentals of the highest ethics in regard to monetary affairs.

F. H. NEWELL,
Washington, May 19, 1923. Consulting Engineer.

Business Men Would Save M. D. & V. R.R.

Business men of Philadelphia and Baltimore are planning to save the Maryland, Delaware & Viriginia R.R. either by forming a new company to purchase it or by getting the Pennsylvania R.R. to purchase it. The M. D. & V. R.R. was recently purchased by E. B. Leaf Co. for scrap.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

Construction of 205 Milles of second track has been authorized by the Atlantic Coast Line Ry. since 1922 and work has been commenced on some portions. About 45 miles of second track were laid last year on the main line between Richmond and Jacksonville.

Among the New York State Bills signed by Governor Smith was the Donohue bill proposing an issue of $50,000,000 bonds to construct buildings for institutions for care, support and training of wards of the state, the proposal to be submitted to the people at the general election in 1923.

Construction Cost is $1,000 per Mile greater than last year for standard 18-ft. cement roads, according to Earl Crawford of the Indiana State Highway Commission. Stone and gravel are 10c. a ton more, and cement 15c. a barrel more, the producers claiming that the increased cost is principally due to increased labor costs.

To Supply Nearly 10,000,000 gal. of water, the daily consumption of its Altoona shops, the Pennsylvania R.R. Co. plans to build a masonry dam 400 ft. long and 78 ft. high across Tipton Run at a point about ten miles east of Altoona. The reservoir so formed will have a surface area of 32 acres and a capacity of 250,000,000 gal. of water. The water from Tipton Run is suitable for railway purposes without treatment.

Both Vehicular Tunnel Bills, passed at the recent session of the New York legislature, were vetoed by Governor Smith last week. One bill called for the construction of twin tunnels to be driven somewhere between 23rd St. and 42nd St., Manhattan, and to be constructed and operated by private capital, and the second bill proposed tubes entering Manhattan in the vicinity of 125th St., to be constructed jointly by the states of New York and New Jersey. Both bills were explained in detail in *Engineering News-Record*, March 1, p. 411.

The Members of the New Mexico Highway Commission appeared in person before the Secretary of Agriculture in Washington on May 31 and urged that they be permitted to depart in certain particulars from the seven per cent system. While Secretary Wallace took their petition under advisement, it is regarded as practically certain that it will be denied. It has been the policy of the Bureau of Public Roads to be very liberal in allowing course construction to proceed. It is practically certain, however, that the regulations would not be liberalized to the extent desired by the New Mexico Commission.

To Electrify All Railroads in New York City

The Kaufman bill, providing for the electrification of all railroads within the limits of New York City, has been signed by Gov. Smith. The bill calls for the work to be completed by Jan. 1, 1926. The magnitude of the changes required by this bill can be judged by the fact that, exclusive of the New York Central which gave no figure as to the estimated cost of the work, the total cost will be $52,000,000. The bill was favored principally by Manhattan interests which desire the removal of steam locomotives from along the west shore of the island. It was opposed by the railroads and by Brooklyn business interests who maintain that at this time the money could be better spent on other facilities.

New York State Reorganization Bill Signed by Governor

The reorganization bill, known as the public works law, passed at the last session of the New York State Assembly, was signed last week by Governor Smith. The bill, as outlined in *Engineering News-Record*, May 17, p. 895, invests the existing State Department of Public Works with new powers and transfers thereto certain bureaus and commissions which now exist as independent agencies reporting only to the Governor, and creates certain other departments and offices. Thus, there is transferred to the Department of Public Works all the powers and duties of the commission on boundary waters between the United States and Canada, of the State Department of Highways, of the Interstate Bridge Commission, of the trustees of public buildings, and of the superintendent of public buildings.

Terms of office of the heads of these departments or of the members of any boards or commissions involved, and of any officers within boards transferred to the Department of Public Works expire July 1, when the act becomes effective. The law provides, however, that heads of bureaus to be transferred may be retained, though in the new position such bureau chiefs report to the superintendent of public works.

A. P. H. A. to Meet in Boston Week Beginning October 8

The fifty-second annual meeting of the American Public Health Association will be held in Boston during the week beginning Oct. 8. Headquarters will be at the Copley Plaza Hotel. There will be the usual laboratory, vital statistics, sanitary engineering, public health administration, industrial hygiene, food and drug hygiene section meetings.

Am. Soc. C. E. Nominations for Officers Are Announced

Francis Lee Stuart, with 537 votes, and C. E. Grunsky, with 285 votes, are the two official nominees for president of the American Society of Civil Engineers, in the ballot canvassed June 1. Only 1339 ballots were received out of a total membership of around 10,000.

Other officers nominated, according to the constitutional provision whereby those receiving 5 per cent of the votes cast in their respective zones and districts are entitled to a place on the ballot, follow:

		Total
For Vice-President, Zone I		
Lincoln Bush	284	
Scattering	84	368
For Vice-President, Zone IV.		
George G. Anderson	170	
Oscar S. Bowen	111	
Scattering	53	334
For Director, District 1	(Two to be elected)	
Paul G. Brown	119	
Thaddeus Merriman	128	
Scattering	134	381
For Director, District 4		
G. H. Blakeley	8	
Robert Farnham	34	
John Meigs	12	
Scattering	12	66
For Director, District 11		
Arthur O. Ridgway	113	
Scattering	7	120
For Director, District 14		
E. A. Hadley	5	
Alexander Maitland, Jr.	62	
C. F. Maitland	5	
Scattering	21	93
For Director, District 15		
J. M. Howe	70	
J. H. Brillhart	43	
Scattering	5	118

Those receiving less than the necessary 5 per cent have been grouped under the heading "Scattering."

American Concrete Institute to Hold Twentieth Anniversary

The twentieth annual convention of the American Concrete Institute is to take place in Chicago, Feb. 25-28, 1924. The board of direction of the institute has already initiated plans for an extraordinarily large meeting in celebration of the twenty years of progress. It is intended to hold in connection with the convention an exhibit of specimen concrete to include finished product, models, drawings, and photographs, which will effectively visualize the progress of twenty years in methods and in achievement. It is not intended to have a commercial exhibit such as was common in cement shows of the past, but to have the exhibition under the auspices of the institute with no space for sale.

"Progressives" Hold Railroad Valuation Conference

Resolution Passed Demanding I.C.C. Conform to Requirements of Valuation Act

Special Correspondence

A conference called by the so-called "progressive" group of congress, in co-operation with some seven governors of Western and Southern states, was held in Chicago on May 25 and 26 for the purpose, as stated in the conference call, of considering certain criticisms directed at the work of the Interstate Commerce Commission in carrying out the provisions of the valuation act of 1913 for the valuation of the steam railroad properties of the United States.

At the opening session of the conference, which was held in the city council chamber and open to the public, there was an address of welcome by Hon. William E. Dever, the newly-elected mayor. The principal speakers at the two public sessions were Senator LaFollette of Wisconsin, Mayor Hylan of New York city, Governor Sweet of Colorado and William Jennings Bryan. The conference was attended by upwards of 100 delegates, including senators and representatives, governors and other state officials, mayors of cities, editors of farm papers and officers of agricultural associations, representatives of railway labor organizations, and others. There were no delegates from the railroad or transportation interests as such. An attempt on the part of the Chicago Association of Commerce through a committee of prominent local business men under the leadership of the traffic manager of that association to secure a hearing was unsuccessful. This attempt took the form of submitting a set of inquiries to the conference. This communication was not answered in the open meeting but by a written reply drafted by the conference at its final executive session. Owing in part to the prominence given by the local press to this heckling incident scant attention was given in the published accounts of the conference to the resolutions adopted regarding the matter which brought the delegates together. These resolutions, which are quoted in full below, refer to valuations of public service properties generally, although in the official call of the conference attention was centered on the valuation of the steam carrier properties, now said to be nearing completion.

Mr. Bryan's Address

Interest in Mr. Bryan's address at the closing public session related mainly to his frank avowal on the relative status of the reproduction cost as against the money outlay theory and to his reference to his own advocacy of the former theory when serving as counsel for the estate in the famous *Smyth-Ames* valuation litigation in the late nineties,—in effect taking issue with the vigorous stand in favor of investment costs taken by Senator LaFollette and by the conference, as reflected in the resolutions made public after adjournment, which are given in full below:

"*Whereas*, The Interstate Commerce Commission is engaged in fixing the valuation of the railroads by authority conferred by Congress, but has failed to comply with many of the mandatory requirements of the valuation act of 1913, particularly in—

"1. Not ascertaining the original cost of railroad properties;

"2. Not ascertaining the amount and value of public donations to the railroads;

"3. Not reporting the methods whereby it arrives at the values fixed; and

"*Whereas*, This valuation work is nearing completion and important precedents will be established in decisions now imminent; and

"*Whereas*, The ascertainment of the actual private investment prudently made in the railroad properties is the primary duty imposed upon the commission, and its failure to perform this duty in compliance with the law will make it impossible to protect the public interest in these valuations and may result in increasing unjustly transportation rates to an amount estimated at not less than $500,000,000 annually; and

"*Whereas*, The principles established in decisions affecting railroad rates must necessarily have a vital bearing upon the determination of the fair and just rates and charges for street railway, telephone, water, gas, electric light and power and other public utility services, and it is important that the public be protected against excessive rates and charges for these services;

"Therefore, be it resolved by this conference that

"1. Representatives shall present to the Interstate Commerce Commission a formal demand that it comply with the requirements of the valuation act.

"2. Upon failure to comply, representatives of this body shall prosecute such legal proceedings as may be necessary to compel acquiescence.

"3. The permanent organization of the conference through its executive committee shall support and direct the conduct of proceedings to accomplish the purposes herein set forth and shall be authorized to employ such legal counsel, engineering, accounting and other expert assistance as will be necessary to carry out this program.

"The conference is further authorized to investigate and take such action regarding other aspects of the transportation problem as may be found advisable to protect and advance the public interest and prepare and promote the adoption of legislation adapted to that end, and do all in its power to increase public information on factors which affect the vital interests of producers, consumers and distributors in economical, efficient transportation service."

Los Angeles Loses Power Suit

The United States Supreme Court on May 21 denied the petition for a writ of *certiorari* presented by the City of Los Angeles in an endeavor to secure a review of the power site condemnation case recently decided adversely to the city by the United States Circuit Court. The city had been endeavoring through this suit to condemn a power site on the Owens River belonging to the Southern Sierras Power Co. and which the city desired to use for power development purposes. The action of the Supreme Court virtually confirms and renders final the decision of the lower court which was, in effect, that no showing had been made that public use by a municipality, such as the City of Los Angeles, was more necessary than that of a utility, privately owned, serving other cities. See *Engineering News-Record*, Sept. 15, 1921, p. 452.

Des Quinze Falls, Que., Project to Produce 20,000 Hp.

The Quinze Power Co., Ltd., has been incorporated by interests associated with the Northern Canada Power Co., with headquarters in Toronto, to develop the Des Quinze Falls on the Quinze River, Quebec. Contracts have been let for the development of a first unit of 20,000 hp. Morrow & Beatty have obtained the contract to build the plant; and Sutcliffe & Neelands, associated with Gordon Summers, have been engaged to survey the transmission line to the Porcupine district.

Wendover Road in Utah Approved as Federal-Aid Project

The Secretary of Agriculture has approved the Wendover Road in Utah as a federal-aid project. This decision based on that provision in the law which empowers the states to lay out its seven per cent system followed an all-day hearing at which representatives of the Lincoln Highway Association urged Secretary Wallace to select as the federal-aid project the highway which runs southwestwardly from Salt Lake City to Ibapah on the Utah-Nevada line. The Governor of Utah, the chairman of the State Highway Commission, the chief highway engineers and others testified in favor of the Wendover route. The plan of the Lincoln Highway Association was opposed by the interested public agencies in Nevada and California as well as by those of Utah. The Wendover road connects in Nevada with a cross-state road which follows the valley of the Humboldt River and which joins the Lincoln Highway at Wadsworth, Nev.

Illinois Central R.R. Plans $41,000,000 Improvements

Important improvement work in progress and contemplated for the Illinois Central R.R. system during the present year, exclusive of equipment, will involve the expenditure of more than $41,000,000, according to an outline furnished by C. H. Markham, president of the road.

The largest item is the construction of the new 173-mile line from Edgewood, Ill., to Fulton, Ky., giving a new main-line route and utilizing the Metropolis Bridge over the Ohio River. The Chicago terminal system comes next with $8,000,000 for the lake front improvement work and part of the electrification project. As on most large railroads at this time additional trackage is an important item, 83.6 miles of second, third and fourth tracks are being planned at an estimated cost of $6,189,600. For freight yards the amount is $3,589,000, mainly for the Markham terminal yard at Chicago, and for yards at East St. Louis, Ill.; Frogmoor, Tenn., and Council Bluffs, Iowa. Next to this comes $3,150,000 for line revision near Central City, Ky., and grade reduction at Paxton and Magnet Hill, Ill., a total of 13.5 miles.

Track elevation at Harvey and Champaign, Ill., is estimated at $1,845,000; signal work, $998,000, and docks and coaling stations $508,000. This last item includes improvements at the Stuyvesant Docks, New Orleans, and coaling stations at Council Bluffs, Iowa, and McComb, Miss.

Rudolph Hering Is Dead

Succumbs in New York City—Began Engineering Career in 1868

Rudolph Hering, long recognized as the dean of American sanitary engineers, died after a short illness in New York City May 30. At his funeral June 1, there were present representatives of the American Society of Civil Engineers, the American Public Health Association, the American Water Works Association, the Engineers' Club of Philadelphia, and other organizations. Besides the reading of the funeral service, there were addresses by Charles Whiting Baker, lately editor of *Engineering News* and *Engineering News-Record*, and a neighbor of Dr. Hering while the latter lived in Montclair, N. J., and by George W. Fuller, New York City, who was for a number of years in partnership with Dr. Hering.

Born in 1847

Rudolph Hering was born on Feb. 26, 1847, in the city of Philadelphia. He was the son of Dr. Constantine Hering, for many years an eminent medical practitioner in Philadelphia, besides being prominent in the early history of homeopathy in America. Rudolph Hering's early education was received in private schools in Philadelphia. In 1860 he was sent to Dresden, Germany, for professional studies. He graduated as a civil engineer from the Royal Saxon Polytechnic College at Dresden in 1867. He took as the subject of a thesis at that institution "Art as Applied to Engineering." The honorary degree of Doctor of Science was conferred on Mr. Hering by the University of Pennsylvania in 1907.

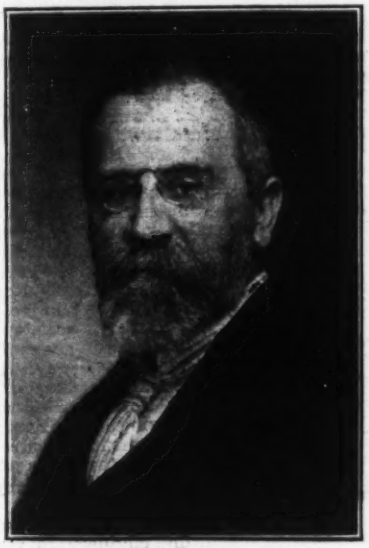
Mr. Hering's work as an engineer began in 1867 on surveys for Prospect Park, Brooklyn, under the late C. C. Martin. Here he served as chainman, rodman and leveler. From 1868 to 1871, he was engaged on surveys and construction of Fairmont Park, Philadelphia. Starting here on a topographical survey of the park area, Mr. Hering suggested that a plane table be used. His immediate superior agreed, but said that there was no one at hand who knew how to use that instrument. When he remarked that he could use it, he was given the opportunity. As a continuation of park work on a larger scale, Mr. Hering helped to survey Yellowstone Park, serving as one of the two astronomers to the expedition

Bridge Work Undertaken

On re-entering the service of the engineering department of the city of Philadelphia in 1873 Mr. Hering was made resident engineer in charge of the Girard Ave. bridge, then the largest highway bridge in America. He had specialized in bridge engineering while at the technical school in Dresden and thus it appeared to him that his aspirations were being fulfilled, but in 1875 he was transferred to sewer work in Philadelphia, thus entering upon what proved to be his career in the field of sanitary engineering. While engaged in sewer work in Philadelphia he did some remarkable work in the standardization of sewer cross-sections. In 1878 and again early in 1880 he tried to get a commission from the city of Philadelphia to go to Europe in order to study foreign sewerage practice. He failed in this attempt, but soon after his second trial he got an introduction to Dr. John F. Billings, surgeon-general, United States Navy, and at that time vice-president of the National Board of Health. There followed the desired commission. The result of this trip was a valuable report on sewerage practice in Europe which was printed by the National Board of Health in 1881.

Mr. Hering's long years in professional work for himself began with the opening of an office in New York City in 1882 as a civil and sanitary engineer. Almost immediately, however, he was called back into the service of Phila-

Dean of American Sanitary Engineers



DR. RUDOLPH HERING

delphia, for which city he made extensive investigations into water supply during the period from 1883 to 1886. No immediate use was made of these studies, but later on they proved of value when he joined with other engineers in a report which led to the construction of a water filtration plant for Philadelphia.

One of the high points in his career was his service in 1886-7 as chief engineer of the Chicago Drainage and Water Supply Commission. This resulted in his recommending disposal of the sewage of Chicago by dilution, the dilution to be afforded by reversing the flow of the Chicago River from Lake Michigan to the Mississippi. In Mr. Hering's report of 1887 he presented a sewage dilution formula in very simple and practical terms consisting of the requisite volume of diluting water for each thousand persons contributing sewage. This formula was made the basis of the design of the Chicago drainage canal years afterwards and its underlying principles, or at least those of sewage disposal by dilution, may be said to have been substantiated by the decision of the United States Supreme Court in the suit brought by the city of St. Louis, Missouri, against the Chicago Sanitary District to enjoin the discharge of the sewage of Chicago into the Mississippi system. Another contribution to the science of sewerage and sewage disposal was made by Mr. Hering later on in 1887 in the form of runoff studies included in a report to General Newton, then commissioner of public works of New York City. By this time he was known throughout the United States as a leading consultant in sewerage and water supply. It was a longer and harder matter to win recognition as an expert on the collection and disposal of garbage and other municipal refuse. For years he was a veritable apostle of scientific means of handling these city wastes. He laid the fundamental principles of this branch of sanitary engineering before the people of this country in papers and reports to the American Public Health Association, of which organization he was for many years one of the few engineer members. A notable report to the association on the subject was made by Mr. Hering in the nineties which contained many valuable data collected by him—as was the case in so much of his pioneer work—wholly at his own expense. Unfortunately, this report was never published. Subsequently, he received now and then a commission as engineer to report on city refuse disposal and for a considerable number of the later years of his active professional work he was one of the few American sanitary engineers to whom cities could go with confidence for expert advice in garbage and refuse disposal. The fruits of his long years of study and thought on this subject, reinforced by repeated visits to England and the Continent of Europe, during which he made minute studies of various types of refuse destructors, appeared in 1921, with many later and supplementary data, in the monumental book entitled "Collection and Disposal of Municipal Refuse," written in collaboration with Samuel A. Greeley.

Partnership With Fuller

After working for many years along the old-time line of consulting engineer with a small personal staff, Mr. Hering entered into a partnership with George W. Fuller, which continued for the period covered by the ten years ended in 1911. During this time the firm did a vast amount of important sanitary engineering work. This line was continued from 1911 to 1915 by a second partnership, with John H. Gregory. After the dissolution of the Hering and Gregory partnership in 1917, Dr. Hering, as he had become in 1907, did less and less active work as a consulting engineer. Much of his time went into the book on refuse disposal, already mentioned, and a part of it was devoted to a somewhat lengthy trip abroad from which Hering returned a few months before his death.

Particular satisfaction was taken by Mr. Hering in his final recognition by the membership of the American Public Health Association by electing him as president for 1913-14. A year or so earlier he had been made the first chairman of the newly organized Sanitary Engineering Section of the American Public Health Association and from the formation of that section until his death he was a member of its committee on garbage and refuse collection and disposal. Hering joined the American Society of Civil Engineers in 1876; was director in 1891, and in '97-'99, and vice-president in 1900-01. He was also a member of the Institution of Civil Engineers and various other technical associations.

A widow and five children survive Dr. Hering, one of the sons being a New York architect.

Random Lines

How They Go About Building Subways in New York

SCENE: A CONFERENCE BETWEEN THE OFFICIALS OF THE CITY AND THE TRANSIT COMMISSION.

Mr. Hulbert (President of the Board of Alderman): He isn't fair. He smiles cynically when he says he will go into a conference.

Mr. McAneny (Chairman of the Transit Commission): I won't tell you what my smile meant, Mr. Hulbert, but I'll admit I was looking at you.

Mr. Hylan (His Honor, the Mayor): The more I hear you talk the less confidence I have in you.

Mr. McAneny: You may observe, Mr. Mayor, that in my desire to have courtesy in this hearing I do not give my opinion about you.

* * *

Out in New Jersey it hasn't rained in two months. A puddle big enough to fill a good hip flask can't be found within fifty miles of New York. But the native mosquitoes, who apparently never have read the entomological books and don't know that they must have stagnant water to breed in, are daily appearing in increasing numbers. What New Jersey needs is a school where mosquitoes may learn where baby mosquitoes come from.

* * *

The Truth About Architects

The other day the Boston *Herald* carried a leading editorial entitled "On Bridges, Architects and Engineers." It served two purposes—it filled over a column of reading matter that otherwise would have taken some thinking and it raised to unholy wrath every engineer in the paper's clientele. "One sees an announcement" says the editorial "that a bridge is to be constructed and then follows the statement that the engineers are preparing the drawings. Why engineers? . . . Architects as a body have the advantage over the engineer. They are better trained, they have a wider field in which to practice and this gives them more training. . . . They are generally drawn from men of high intellectual ability" and more in the same vein not answering the rhetorical question of the second sentence but proving the worthiness of the architect as a bridge builder. So far none of the infuriated engineers who have sought out the editor of the *Herald* has been able to inflict the bodily harm intended—but that is because he has retreated to the refuge of his sanctum whence he is vainly seeking to extract an apology from the high school sophomore who wrote the editorial that afternoon the editor was out on Devonshire St. admiring the intellectual way the architects were putting down those funny foundations of the First National Bank Building.

* * *

Rupert Hughes has written a new best seller in which the New York water supply competes against sex as the major interest. If we can only get enough novelists to take engineering seriously the profession may in time amount to something.

A. S. M. E. Holds Convention in Montreal

The annual convention of the American Society of Mechanical Engineers was held at the Mount Royal Hotel, Montreal, May 28-31, with an attendance of about 250 from all parts of the United States. Members of the Engineering Institute of Canada took an active part in the proceedings.

The technical program gave special prominence to papers on hydro-electric development in view of the many important enterprises of that character now under way. O. P. Hood, chief mechanical engineer of the U. S. Bureau of Mines, presented a paper on "Lignite Char," its production and possibilities, showing how lignite might be made a marketable fuel without resorting to the briquetting process, which was followed by a discussion.

A paper prepared by Julien C. Smith, vice-president of the Shawinigan Water and Power Co., dealt with power development in Quebec. He estimated the potential electric energy of the province at approximately 13,000,000 to 15,000,000 continuous kilowatts, the available commercial waterpower being about 4,500,000 kw. of continuous power, and outlined the various companies engaged in power distribution and the difficulties they had encountered. H. R. Naylor, assistant works manager of the Angus shops of the Canadian Pacific Ry., gave a description of steel car construction. R. B. Wolf, of New York, treated of "Management Engineering in the Paper Industry." The development of hydro-electric power plants in Ontario was set forth in a paper by Frederick A. Gaby of Toronto.

At the session of the thirtieth Fred W. Cowie, consulting engineer to the Montreal Harbor Commission, presented a comprehensive paper on the port of Montreal, describing its growth and progress during the last hundred years and the measures taken to overcome climatic difficulties. The afternoon was devoted to excursions and visits of inspection to industrial plants. The principal feature of the concluding day of the convention was an address on aircraft by J. A. Wilson, secretary of the Canadian Air Board, showing what had been done during the last three years in the adaptation of aviation to peace-time purposes.

The nominating committee made the following selections for 1924 officers: President, Fred R. Low, editor *Power;* vice-presidents, George I. Rockwood, M. L. Cooke, W. J. Sando and treasurer, W. H. Wiley.

Highway Officials Association Fills Vacancies

Vacancies on the executive committee of the American Association of State Highway Officials have been filled as follows: Lewis D. Blauvelt, state highway engineer, Colorado, to succeed D. P. Olson; W. S. Keller, state highway engineer, Alabama, to succeed G. P. Coleman. Mr. Blauvelt's term expires in 1926 and Mr. Keller's term in 1927. The executive committee approved the appointment of Clifford Older, state highway engineer, Illinois, to represent the Association on the Standards Committee of the American Engineering Standards Committee. Mr. Coleman presented his resignation as chairman of the executive committee.

Florida East Coast Ry. Plans

Improvement work on the 1923 program of the Florida East Coast Ry. includes the following items, in addition to numerous sidetracks and yard track extensions: Grade reduction and long passing track at White City; engine terminals at New Smyrna in connection with recent extension of freight yards; extensive bridge work at South Jacksonville and Little River; new departure tracks for the freight yards at New Smyrna, South Jacksonville and Fort Pierce. Construction of 20 miles of the new line from Okeechobee to Miami (see *Engineering News-Record* of March 8, p. 459) is already under contract and it is planned to build 15 miles more to Pahokee.

Shasta Route Blocked by Railroad Tunnel Fire

Fire in the timber lining of a Southern Pacific R.R. main line tunnel 10 miles north of Redding, Calif., on May 22 caused a cave-in that for several days blocked the Shasta Route which is the only direct rail connection between California and the Pacific Northwest. A shoofly built around the tunnel was put in service on May 29 at which time the hauling of baggage and mail by motor trucks for a distance of 29 miles around the blocked tunnel was discontinued. Passengers were not taken over the truck route, instead, until the shoofly was completed, they walked a distance of 200 yd. around the tunnel on an easy grade, thus transferring to trains on the far side of the blocked tunnel. Endeavor was concentrated on getting the shoofly in operation so that trains could go through, and on May 28 no prediction as to date of reopening the tunnel was offered by company officials.

This fire brought out comment on the importance of completing the Natron cut-off, a projected secondary route over the Siskiyous to the east of the present line and on which considerable construction work has already been done.

To Stabilize Construction by Analysis and Forecast

As a means of preventing inflation in the construction industry a special committee of the American Construction Council, following a meeting in New York May 31, at which Secretary of Commerce Hoover was present, has announced a plan for keeping the public informed of conditions with regard to labor and materials. The program involves the collection and analysis of statistics which will form the basis of a weekly forecast covering the United States as a whole and also individual districts. The membership of the council's special committee, which met at the office of Franklin D. Roosevelt, president of the council, included Edwin F. Gay, of the New York *Evening Post;* M. C. Rorty, president, National Bureau of Economic Research; Brig.-Gen. R. C. Marshall, Jr., general manager, Associated General Contractors of America, and Noble Foster Hoggson, chairman of the council's executive committee. Secretary Hoover was accompanied by Dr. John M. Gries, chief of the Division of Housing and Construction of the U. S. Bureau of Standards. The program recommended to flatten out the peaks and valleys in the building industry has received Mr. Hoover's endorsement.

Engineering Societies

Calendar

Annual Meetings

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION; Annual Convention, Ithaca, N. Y., June 20-23.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Annual Meeting, Atlantic City, N. J., June 25-29.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, Annual Convention, Chicago, July 11-13.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Convention, Burlington, Vt., Sept. 18-21, 1923.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York; Annual Meeting, Boston, Oct. 8-11.

The Associated General Contractors of America recently organized a chapter at Houston, Tex., with Bailey Houx as president, Charles K. Horton as vice-president, H. C. Vogt, secretary, and Thomas L. Murray, treasurer.

The Columbus, Ohio, Engineers' Club at a recent meeting installed the following officers for the coming year: H. D. Brunning, president; C. D. McGuire, secretary; Ross Purdy, treasurer; and W. H. Dittoe and G. F. Schlesinger, vice-presidents.

The Providence, R. I., Engineering Society will on June 9, 1923, for its annual automobile outing trip go to Fairbanks Farm, Greene, R. I., the home of Frederick R. Inman. Return will be by way of the Scituate dam.

Personal Notes

JOHN PAUL DAVIS, city engineer, Logansport, Ind., has resigned to accept a position with the Bowyer Construction Co., Newcastle, Ind., with which he had previously been connected.

W. H. ELLISON and EARLE RUSSELL of San Francisco, Calif., have formed a partnership for the practice of structural engineering, with a San Francisco office in charge of Mr. Ellison and a Los Angeles office in charge of Mr. Russell.

COL. W. W. CROSBY, formerly of Baltimore, and now superintendent of Grand Canyon National Park, Arizona, returned last week from a trip around the world, during which he took advantage of his visit to the Orient to study highway conditions there. He made stops in Hawaii, Japan, the Philippines, Hong Kong, the Malay States, Ceylon, and Suez, and then went to Seville to attend the International Road Congress. He is now in Washington and expects to return to the Grand Canyon shortly.

CARL P. HUBBARD has left Lockwood, Greene & Co., to enter the organization of Stone & Webster, Inc., of Boston, Mass. Mr. Hubbard is a graduate of Tufts College. Following his graduation he obtained a broad experience in construction work with the Aberthaw Construction Co. of Boston and with Lockwood, Greene & Co. At the beginning of the war he enlisted as a private in the First Reserve Engineers of New York which later became the Eleventh Engineers. He went to France with this regiment, was commissioned as first lieutenant soon after his arrival and was later promoted to a captaincy. After being discharged from the army he was made resident engineer for Lockwood, Greene & Co., later becoming supervision engineer stationed at Chicago. He is now in the Chicago branch of the Stone & Webster organization.

MAJOR GRAHAM A. BELL has resigned as vice-president of the Canadian National Railways in charge of finance, and resumed his former office as deputy minister of railways and canals for the Canadian Government. The post of vice-president in charge of finance and accounts will remain unfilled for the time being and under the direction of President Thornton.

ANDREAS BAALSRUD, Norwegian director of public roads, who is traveling in America investigating problems of highway construction, is visiting Winnipeg, Can., to confer with the Manitoba highway commissioner and engineers.

NORMAN F. BROWN, vice-president of the Dravo Contracting Co., Pittsburgh, Pa., has resigned and will engage in private practice in Pittsburgh as a consulting engineer dealing with railroad and transportation problems and municipal work.

WILLIAM T. CROWLEY, city engineer of Lock Haven, Pa., has resigned to become associated with the Smallman Brice Construction Co., as general superintendent of construction on a large reinforced-concrete warehouse at Birmingham, Ala.

MAJOR GENERAL LANSING H. BEACH, the Chief of Engineers, is paying a personal visit to Missouri River points.

E. L. HOOPES, division engineer, Pennsylvania R.R., has been transferred from Grand Rapids, Mich., to Columbus, Ohio.

L. L. MILLS, city engineer of San Rosa, Calif., has resigned to enter private practice, effective June 1.

SEATON SCHROEDER, JR., has opened a consulting engineering office in the Victory Bldg., Philadelphia, Pa., for surveys, investigations, reports, industrial design and supervision. Mr. Schroeder was connected with the Civil Engineering Corps of the Navy during the war and later with the Turner Construction Co. and William T. Anderson, Inc.

LYNCH CONSTRUCTION CO., INC., announce the occupation on May 1 of new offices at 1619-1623 Pershing Square Bldg., New York City.

The JAMES H. HERRON Co., Cleveland, announces that it has associated with it George W. Helling, who will assume charge of the department of steel and concrete inspection.

WARREN J. MACEVOY and HARRY E. NONEMAKER, Newark, N. J., have formed a partnership, the MacEvoy Construction Co., for concrete building construction. Mr. MacEvoy has been in charge of the new $2,500,000 Center Market at Newark, for the Clifford MacEvoy Co., and Mr. Nonemaker, prior to being superintendent for the same project, was connected with the Industrial Engineering Co., New York City.

R. W. E. BOWLER has been appointed division engineer of the Pennsylvania R.R. at Grand Rapids, Mich., succeeding E. L. Hoopes, transferred.

MAJOR GEORGE J. RICHARDS has succeeded Major Hodges as U. S. Engineer at Memphis, Tenn., in charge of the first and second districts of the Mississippi River Commission. Major Hodges is transferred to Fort Sam Houston, Texas.

R. C. STARRETT, field engineer for the Merced Irrigation District at Merced, Calif., has been appointed chief engineer of the district, filling the vacancy caused by the death of Rex C. Starr.

F. A. RHODES has been reappointed city engineer and city manager of San Diego, Calif.

Obituary

THOMAS M. ARTHUR, contractor, West Toronto, Ontario, died May 20, aged 62 years. Mr. Arthur was for some years associated with the civil engineering staff in the early activities of the Canadian Pacific Ry., Iron Mountain division, and later was connected with the Duluth, Mesaba & Northern Ry. on the Iron Mountain division.

CHARLES W. KNIGHT, of the civil engineering firm of C. W. Knight & Son, Rome, N. Y., died recently at the age of 76 years. Mr. Knight had been engaged for fifty years in the design and building of many of the large sewer and water systems in New York State.

LEWIS NEIL HOPKINS, assistant engineer, Syracuse office of the New York State Highway Department, died recently of injuries sustained in a motor accident at Cortland, N. Y. Mr. Hudson came to New York from Baltimore.

MYRON LEWIS THOMPSON, Brooklyn, N. Y., for many years construction engineer with the Standard Oil Co., died May 26, aged 60 years. In his work for the Standard Oil Co. Mr. Thompson traveled all over the world. Several years ago he joined the engineering staff of the Texas Oil Co.

HERMAN C. SCHNEIDER, East Orange, N. J., died May 20, at the age of 52. He was founder of the Herman C. Schneider Building Construction Co. of Newark, N. J., which began the project of the Robert Treat Hotel, and also erected theaters, schools and apartment buildings in Newark.

PROF. ERNEST D. PARTRIDGE, Brigham Young University, Provo, Utah, died recently in a Denver, Rio Grande & Western train wreck near Price, Utah, while en route to the American Association of Engineers convention at Norfolk, Va. He was professor of agricultural engineering at Brigham Young University and was in charge of the engineering and mathematics courses. After the meeting of the A.A.E. he was to have visited several Eastern colleges and then to have returned to the Agricultural College at Ames, Iowa, to spend three months specializing on road building problems, under a scholarship recently granted him.

ROBERT A. LAWRIE, for twenty years surveyor of White County and city engineer of Monticello, Ind., died May 21 at Richmond from a stroke of apoplexy.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Asphalt Conference Cuts Varieties to Ten

Elimination of Eighty Grades Made by Unanimous Adoption of New Scale of Penetration Limits by Users and Producers

Engineering News-Record Staff Report

USERS and producers of asphalt for street and road work, in conference with the Division of Simplified Practice of the U. S. Department of Commerce in Washington, D. C., May 28, agreed by unanimous vote to limit the varieties (as determined by the penetration test) of asphalt for all purposes of paving to 10 standard ranges of consistency, thus eliminating about 80 varieties called for in highway and paving specifications during 1922, according to a survey of shipments made by the producers. The new scale of penetration limits comprises 9 grades for paving purposes, (Table 1A), and 4 grades for brick and block joint filler shown in Table 1B; only one of the joint filler grades, however, is different from those in Table 1A. The action of the conference is in line with Secretary Hoover's program for the elimination of waste in industry and will be submitted for ratification to all of the state highway departments, city and county engineers, engineering societies concerned with asphalt specifications, and producers of asphalt. In the event of approval by 80 per cent of the list canvassed the new scale of consistencies will be issued in pamphlet form by and with the approval of the Department of Commerce as one of its series of simplified practice recommendations.

The conference last week, following one on April 24 limited to asphalt producers, was attended by official representatives of the American Society of Civil Engineers, the American Society for Municipal Improvements, state highway departments, municipal street and paving bureaus, the U. S. Bureau of Public Roads, the U. S. Geological Survey and the Chamber of Commerce of the United States. The action of the conference marks a definite step forward in the simplification of highway specifications for asphalt and, if ratified, will result in a marked reduction of wasteful practices in the operations of production. When the case for fewer grades of asphalt was presented and discussed in *Engineering News-Record* of Sept. 28, 1922, p. 539, and subsequent issues, it was stated that "multiplicity and non-uniformity of specification requirements have reached a point which demands nation-wide co-operative action on the part of engineers, contractors, and producers to secure a reduction in the number of different grades of asphalt called for without in any way lowering the quality of construction involved." As a means of improving the conditions thus outlined the action of the conference comes as the initial decisive move.

Table 1—Penetration Limits for Asphalt

Approved by Conference of Users and Producers at Washington, D. C., May 28, 1923.

A.—Asphalt for Roads and Pavements

25-30	85-100
30-40	100-120
40-50	120-150
50-60	150-200
60-70	

B.—Asphalt for Joint Filler

30-50	60-70*
50-60*	85-100*

*These three grades the same as in tabulation in above.

Table 2—Penetration Limits, Tentative Standards, American Society for Testing Materials

25-30	70-90
30-40	90-120
40-50	120-150
50-60	150-175
60-70	

The meeting last week, at which William A. Durgin, chief of the Division of Simplified Practice, presided, was arranged primarily to secure agreement between the producing and the consuming interests, which were about equally represented. As a basis for discussion, R. M. Hudson, of the Commerce Department, presented the results of a survey of asphalt shipments in 1922 (by percentages) submitted according to an agreement reached by the producers at their meeting with the Division of Simplified Practice April 24. The figures showed a total of 88 grades for paving asphalt and 2 additional grades for brick and block filler, or a total of 90, based on returns from 14 producing companies, representing a large proportion of the country's output. Approximately 81 per cent of shipments fell within the penetration ranges in the scale of grades tentatively adopted by the American Society for Testing Materials and approved in April by the producers. The number of different grades which raise the total to 90 are found principally in the remaining 19 per cent of shipments. These figures were cited by Prevost Hubbard, of the Asphalt Association, as conclusive evidence of the feasibility of eliminating excess varieties, and reinforced the statistics presented at the April 24 meeting by Col. R. Keith Compton of the Baltimore Paving Commission.

Changes in A.S.T.M. Scale

Opening the discussion from the consumer's point of view, Col. Compton stated that in general there was no objection to the A.S.T.M. penetration scale. On his suggestion the state and city engineers withdrew from the meeting for a brief conference, which resulted in an endorsement of the scale with the elimination of the 70-90 grade and several other changes. William H. Kershaw, of the Texas Co., pointed out that there was practically no demand for the 80-90 grade. After further discussion, the grades 70-90, 90-120, and 150-175 were eliminated and for them were substituted grades of 85-100, 100-120, 120-150, 150-200. With these changes, the scale of penetration limits shown in Table 1A was approved.

It was emphasized by Mr. Durgin that the ladder of standard grades will accomplish its object only if purchasers of asphalt adhere strictly to it by calling for and accepting material within the range of limits shown. In specifying, for example, the 40-50 grade, the highway engineer is, in effect, calling for 45 penetration with a tolerance of 5 points above and below that figure. To emphasize this point, Mr. Durgin rearranged the figures of Table 1 to indicate the practical working out of the new scale.

Along the same lines, Mr. Kershaw made a plea for an adherence to the ladder in Table 1, saying that "if purchasers attempt to work out refinements in the scale approved the result of this conference is nil." The approved scale of penetration limits, on motion of R. S. Townsend, of the Atlantic Refining Co., becomes effective for deliveries after Jan. 1, 1924.

In the discussion preceding the adoption of Table 1 a number of points covering the production and use of asphalt were touched upon. Speaking for the U. S. Bureau of Public Roads, A. T. Goldbeck said that the penetration ranges tentatively approved by the A.S.T.M. coincided with those of the Bureau. In selling asphalt to meet a 10-point range in penetration limits, according to Mr. Kershaw, the refineries actually hold to a narrower range to allow for slight variations and to make sure that the product will fall within the ranges specified. The practice in Chicago, according to Edward N. Eaton, of the Board of Local Improvements, is to specify for sheet asphalt a penetration of 50, with a definite leeway up or down. New York City, according to Dr. Felix Kleeberg, of the Department of Public Works, has

Standard Dimensions for Face Brick

At a preliminary meeting at the Department of Commerce May 11 between a committee of the American Face Brick Association, J. W. Ginder, chairman, Specifications Committee of the Supervising Architect's Office, Treasury Department; A. L. Harris, American Institute of Architects, Washington, Paul E. Holden, U. S. Chamber of Commerce, and R. M. Hudson of the Division of Simplified Practice, it was resolved that the Department of Commerce be asked to call a general conference consisting of representatives of face and common brick manufacturers, architects, contractors, builders, and federal representatives some time during the week of June 18 to consider the adoption of the following standard dimensions for face brick: Rough face brick "approximately 8x2¼x3¾ in. Smooth face brick "approximately 8x2¼x3¾ in.

A partial survey recently conducted by the American Face Brick Association showed that 167 plants throughout the United States manufactured 39 different sizes of rough brick during 1922, and that 141 plants manufactured smooth brick in 36 varieties.

recently standardized asphalt specifications for the five boroughs of the city in which an odd-scale penetration—that is, 35-45, 45-55, etc.,—was adopted. From the producer's point of view, Herbert Spencer, Standard Oil Co. (New Jersey), spoke of the undesirability of having the stills make special runs to produce asphalt of non-standard grades. Another disadvantage under the same head is the resulting inability to make deliveries quickly from stock.

JOINT FILLER

The conference also adopted four standard penetration limits for brick and block joint filler, as indicated in Table 1B. This table, it will be noted, adds only one new grade to the nine shown in Table 1A. This additional grade, of 30-50 penetration, is intended primarily for brick pavement; the other three grades—50-60, 60-70, and 85-100—are intended for admixture with sand to form an asphaltic grout for use in stone block construction. The three latter grades, while they are included in Table 1A, are repeated in Table 1B to indicate to the paving engineer the complete range of four standard grades of material for joint filler.

After the approval by the conference of the penetration scale for paving asphalt and for joint filler, Prevost Hubbard, of the Asphalt Association, was appointed to bring the action of the conference before the forthcoming annual meeting of the American Society for Testing Materials. The Department of Commerce will transmit to highway officials and producers throughout the country the results of the action of the conference with regard to a standard scale of penetration limits and ask for endorsement.

PERSONNEL OF CONFERENCE

For the American Society of Civil Engineers and also the American Society of Municipal Improvements, Col. R. Keith Compton, Baltimore Paving Commission, was the official delegate. J. H. Cranford was the delegate of the Federated American Engineering Societies. Irving W. Patterson, chief engineer, represented the Rhode Island State Highway Department. The state highway departments of Pennsylvania and New Jersey were represented, respectively, by Malcolm H. Ulman and Fred H. Baumann. Municipal paving departments were represented by Dr. Felix Kleeberg, New York, Edward N. Eaton, Board of Local Improvements, Chicago, and George Cobb, Baltimore Paving Commission. For the U. S. Bureau of Public Roads A. T. Goldbeck and B. A. Anderton attended.

For the producers the representatives were: H. R. Gundlach, U. S. Asphalt Refining Co. and the Interocean Oil Co.; C. N. Forrest and C. M. Foster, Barber Asphalt Co.; W. H. Kershaw, the Texas Co.; Herbert Spencer, Standard Oil Co. (New Jersey); Burton L. Boye, Standard Oil Co. (New York); Irvin K. Giles and R. S. Townsend, Atlantic Refining Co.; Leroy M. Law, New Orleans Refining Co.; H. T. Hulin, Mexican Petroleum Corp.; Prevost Hubbard, Asphalt Association.

Other interests represented at the conference were the Chamber of Commerce of the United States by E. W. McCullough; National Slag Association, by H. J. Love; *Engineering News-Record*, by R. K. Tomlin, Jr.; U. S. Geological Survey, by Frank J. Katz, and K. W. Cottrell.

Strong Paper for Cement Bags

To insure against breakage during shipment and handling on the job, the Atlas Portland Cement Co. has adopted an extra heavy old manila rope fibre paper for its bags. A sample of the paper is employed as the cover of the company's bi-monthly publication, the "Contractors Atlas," as a means of acquainting cement users with the quality of the material in the new containers. Paper made from new manila fiber, it is stated, is not as strong as that manufactured from fiber taken from old rope. Before being made into bags for cement the paper is carefully tested by the paper manufacturer and when the bags are received at the cement plant samples are submitted to the laboratories for test to insure adequate strength.

For cement users who are considering whether or not to order shipments in paper bags the following advantages for the paper containers are advanced: With the non-returnable paper bag there is no loss from stolen or damaged cloth cement bags. The expense of cleaning, sorting, bundling and storing cloth bags is eliminated. Freight charges for hauling empty cloth bags are wiped out. Paper bags, it is claimed, are more easily handled on the job for there is no time lost in untying and shaking; a paper bag may be ripped open, allowing the cement to slide easily into the loading skip of the mixer.

Functions of Trade Associations Indicated by Vote

Approval of the existence of properly functioning trade associations for each important branch of industry and commerce in the country was voted by business organizations affiliated with the Chamber of Commerce of the United States in a recent preliminary referendum canvass of answers to eight propositions taken from the report of the special committee created by action of the Board of Directors of the National Chamber in 1922 to "make a general survey of trade associations, consider activities of trade associations which are in the interest of the public and of the fields of enterprise which are represented." The committee expressed itself as of the opinion "that, while a minority of trade associations may have engaged in practices which have laid them open to complaint under the law with respect to restraints of trade, the vast majority have proved their great value for the advancement, day by day, of the processes of production and distribution."

COMMITTEE'S RECOMMENDATIONS

The committee laid down as its recommendations three rules with relation to the statistical activities of trade associations, as follows:

"Reports of members to their association should be accurate and sufficiently complete to prevent misconstruction.

"As distributed to the membership, the statistics should not be accompanied with any interpretation or other comment which could induce or facilitate concerted action on the part of members.

"All statistics regarding prices should be confined to closed transactions, and should not refer to pending transactions or future transactions."

To Cut Roofing Varieties

At a convention of the Prepared Roofing Association in Washington May 23, the organization adopted resolutions favoring a reduction in varieties from 27 to 10. A committee will draft resolutions and a plan for elimination which will be carried forward in co-operation with the Division of Simplified Practice of the Department of Commerce.

Business Notes

CHAUSSE OIL BURNER CO. has been incorporated in Michigan to manufacture oil-burning apparatus for asphalt street repairing, for installation in electric railway cars, for production of house furnace burners and the manufacture of oil-burning hand torches. The company is incorporated for $100,000 and its officers are W. McK. White, president, W. G. Chausse, vice-president, Wray P. White, secretary. Offices have been opened in Detroit and plans are being made for the location of a factory either in Detroit or in a nearby city.

H. E. MARKS CORP., Pittsburgh, manufacturer of gypsum roofs, announces the appointments of Henry M. O'Grady, as sales representative in Richmond, Va., and adjacent territory, and of William B. Smith as district sales representative in Texas and Louisiana, with headquarters in San Antonio.

EDWARD L. SOULÉ CO., San Francisco, has established an office at Fresno, to care for the iron and steel requirements of the San Joaquin Valley. Floyd T. McKune is the local representative. The Soulé company is preparing plans for a fabricating shop and warehouse to be located at Fresno to serve the district from Modesto to Bakersfield.

GEORGE C. JONES, INC., New York, announces that Frank C. Boes has joined the organization in the capacity of treasurer, in direct charge of sales of road-building machinery and construction equipment.

COMBUSTION ENGINEERING CORP., New York, manufacturer of stokers and other power-plant equipment, announces the appointment as its Southern agent of T. J. Cleary, Candler Building, Atlanta, Ga.

SOUTHERN PINE ASSOCIATION, New Orleans, has established a branch inspection office at 2030 Grand Central Terminal Building, New York City, with T. M. Cook, inspector in charge. The object of the new branch is to give quicker and more efficient service to lumber buyers in New York, Brooklyn, and New Jersey shipping points.

ASPHALT ASSOCIATION, J. E. Pennybacker, secretary, announces the creation of two new district offices for field work and the appointment of two field engineers to succeed James R. Valk, deceased, and John B. Hittell, resigned. A third district engineer will be appointed shortly. The southeastern district has been moved from Atlanta, to Charlotte, N. C., and placed in charge of Lloyd D. Smoot, of Washington, D. C., formerly general superintendent of the Atlantic Bitulithic Co. Mr.

Smoot's career has included 7½ years of service as Director of Public Works at Jacksonville, Fla.

As successor to John B. Hittell, who resigned recently as district manager in Chicago to accept reappointment to his old position as chief street engineer, Chicago Board of Local Improvements, the Asphalt Association has appointed George W. Craig, for the past ten years city engineer of Calgary, Canada. From 1909 to 1913 Mr. Craig was chief engineer for the city of Omaha, Neb. From 1907 to 1909 he was engaged in engineering and contracting as a member of the Katz-Craig Contracting Co.

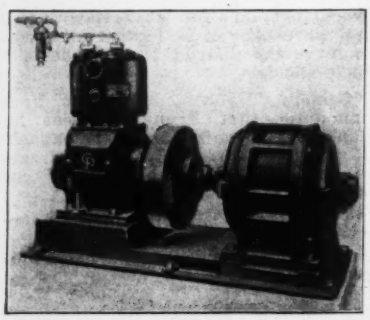
Arrangements are being made by the Asphalt Association to open a new southwestern district office in Kansas City, Mo.

GIBB INSTRUMENT Co., Bay City, Mich., manufacturer of electric welding equipment, has been appointed distributor of the General Electric Co.'s arc welding electrodes in the Middle West.

Equipment and Materials

New Air Compressors Directly Connected to Motors

The Chicago Pneumatic Tool Company has recently developed a line of high-speed compressors which can be directly connected to electric motors or internal combustion engines by means of flexible couplings. Because of the speed restrictions imposed by the limited area of the compressor valves used, the company states, such combinations heretofore have been unavailable and as a result, belt drive and, in some



instances, gear drive have been employed.

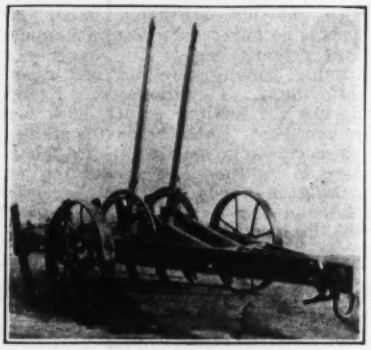
The new compressors are of the vertical, duplex, single acting, water-cooled type, fitted with Simplate flat-disc inlet and discharge valves. The straight and uniform lift of these valves affords a maximum of effective valve area which makes possible the speed at which these compressors operate.

The machines are built in three sizes, having piston displacements of 128, 160 and 210 cu.ft. per minute, and are suitable for working pressures of 150 lb. per square inch. The standard speed of these sizes is 600 r.p.m. Standard equipment includes a hand starter for the motor and an inlet valve unloader for the compressor.

For those places where the demand for air is intermittent the motor can be furnished with an automatic starter which starts and stops the unit within predetermined pressure limits. When this type of starter is used, the compressor is equipped with a centrifugal unloader which automatically relieves the compressor of its load while the motor is starting up or shutting down—a condition which is essential to the successful operation of any automatically controlled compressor. A water control valve is also furnished which is operated by air pressure governed by a centrifugal unloader and since the lubrication is accomplished by a combination pump and splash system, the unit is automatic, as it accurately controls the electric current, air delivered, circulating water, and lubrication.

New Subgrade Scarifier

For use in scarifying the subgrade of roads preliminary to mechanical subgrading the Lakewood Engineering



Co., Cleveland, has developed the Graderooter, shown in the accompanying illustration. This equipment is new this season and is designed to stand up under severe use on all kinds of scarifying work encountered on the average road job. Some contractors are using the machine in place of a rooter plow. The rooter is furnished with two sets of five teeth each and one special manganese tooth alone for particularly heavy work. The machine weighs 1,300 lb. and can be furnished for tractor or team hitch.

Steam Shovel Clears Snow From Snoqualmie Pass

Equipped with a 4-cu.yd. dipper, five times the size ordinarily employed, an Erie steam shovel of the revolving, crawler-tread type was used in clearing

SNOW CLEARED FROM SNOQUALMIE PASS BY STEAM SHOVEL

snow from the Snoqualmie Pass through the Cascade Mountains in Washington and opening up the route to traffic on May 15 under a contract between the State Highway Department and Rumsey & Jordan, of Seattle. The shovel started work on a 6-mile stretch of snow-packed road on April 24. Operations were speeded by the large capacity dipper and by the use of the caterpillar type of mounting under the shovel, permitting it to move without delay for laying planking or swinging around mats.

New Culvert Pipe, in Four Sizes, Has Great Crushing Strength

To meet the demands caused by the present heavy weights of motor trucks on roads the W. S. Dickey Clay Manufacturing Co., Kansas City, Mo., has designed a special culvert material known as triple-strength vitrified clay pipe, made in sizes of 15, 18, 21 and 24 in., with the following specifications:

Diam., in.	Thick., in.	Wt. per ft., lb.	Crushing Strength, lb. per lin. ft.
15	1¾	100	4,570
18	2	136	6,400
21	2¼	186	6,020
24	2½	240	6,440

The advantages of this material for road culverts, its manufacturer points out, include its ability not only to carry heavy loads, but also to resist rust or decay and resist the action of acids.

Publications from the Construction Industry

Concrete Mixers—T. L. SMITH Co., Milwaukee, has just issued a 48-p. illustrated catalog devoted mainly to its non-tilting type of concrete mixers. The first portion of the text explains in detail the main parts of the equipment, including drum, discharge spout, frame, driving mechanism, power loader, water measuring tanks, etc. The capacities of the machines illustrated range from 4 to 28 cu.ft. of mixed concrete. The power equipment includes steam and gasoline engines and electric motors. The catalog contains detail specifications of the various mixer types, data on weight and cubical contents, and sketches showing dimensions.

Swimming Pool Sanitation—WALLACE & TIERNAN Co., INC., Newark, N. J., has issued a bulletin on the use of its chlorinating apparatus for the sanitation of swimming pools.

Lumber and Its Utilization—NATIONAL LUMBER MANUFACTURERS ASSOCIATION, Chicago, announces a series of bulletins on lumber and its utilization. The subjects to be covered are: General information, timber, lumber, construction, fire-prevention, craft and carpentry.

Sluice Gates and Hoists—CHAMPION ENGINEERING Co., Kenton Ohio, is distributing five leaflets illustrating caterpillar types of sluice gates manufactured under the Broome patents. Information is given also on the company's hand and power operated sluice gate hoists.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Average Weekly Value of May Contracts Let About Two Per Cent Heavier Than in 1922

Total of 1,016 Awards During May, Average Value $215,267, Compared With 794 in April, Averaging $250,629

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 333 to 348, are the following:

Library, Cleveland, O., for Cleveland Public Library Board, $3,550,000.

Engineering News-Record Construction Cost Index Number

June, 1923	220.70
May, 1923	216.70
June, 1922	166.62
Peak, June, 1920	273.80
1913	100.00

Engineering News-Record's Construction Cost Index Number advanced 4 points since last month due to stiffening in labor rates. Prices of basic materials remained unchanged during month. The average rate for common labor is now 53c. Thus, general construction cost is 32 per cent higher than one year ago and 19 per cent under the peak; it is 121 per cent above the 1913 level.

Engineering News-Record Construction Volume Index Number

Monthly	
May 1923 (5 *issues of E. N.-R.*)	171
April 1923 (4 *issues of E. N.-R.*)	160
May 1922 (4 *issues of E. N.-R.*)	179
1913	100
Yearly	
1922 (entire year)	130
1921 (entire year)	88
1920 (entire years)	91
1913	100

Engineering News-Record's Construction Volume Index Number is 171 for the month of May, and 130 for the whole of 1922, as against 100 for 1913. This means that the actual volume of construction in 1922 (not the mere money-value of the contracts let that year) is 30 per cent above the volume of construction for 1913. Our monthly volume number, 171 for May, 1923, is really the increment of construction, and indicates the rate at which contracts are being let as compared with 1913 awards.

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA DURING MAY, 1923

	New England	Middle Atlantic	Southern	Middle West	West of Mississippi	Western	Total United States	Canada	Total
Water-works	$120,000	$2,244,000	$231,000	$1,445,000	$475,000	$2,457,000	$6,972,000	$357,000	$7,329,000
Sewers	167,000	3,746,000	414,000	3,502,000	500,000	533,000	8,862,000	190,000	9,052,000
Bridges	858,000	137,000	660,000	892,000	706,000	10,395,000	13,648,000	245,000	13,893,000
Excavation, drainage and irrigation			700,000	275,000	2,423,000	115,000	3,513,000	40,000	3,553,000
Streets and roads	1,316,000	6,417,000	10,402,000	9,215,000	5,471,000	5,446,000	38,267,000	8,261,000	46,528,000
Industrial works	3,575,000	3,537,000	1,399,000	6,195,000	5,893,000	2,251,000	22,850,000	1,030,000	23,880,000
Buildings	9,908,000	30,238,000	6,600,000	22,763,000	4,786,000	7,232,000	81,527,000	7,997,000	89,524,000
Federal government		115,000	839,000	92,000	1,558,000	281,000	2,885,000		2,885,000
Miscellaneous	115,000	3,984,000	2,568,000	981,000	3,777,000	2,083,000	13,508,000	8,560,000	22,068,000
Total	$16,059,000	$50,418,000	$23,813,000	$45,360,000	$25,589,000	$30,793,000	$192,032,000	$26,680,000	$218,712,000

The total value of contracts awarded on large engineering construction projects, in the five May issues of *Engineering News-Record*, reached $218,712,000 as compared with $198,665,000 in the four issues of April. This represents an average weekly value of $43,742,400 for May, against $49,750,000 during the preceding month.

The weekly average for the month of May, $43,742,400, represents an increase in money value of 2 per cent above the weekly average of $42,889,000 for the corresponding period in 1922.

The number of awards totaled 1,016 during May, with an average value of $215,267 as compared with 794 in April, averaging $250,629 per contract.

Minimum costs observed in Construction News on each class of construction are as follows: Water-works, $15,000; other public works, $25,000; industrial construction $40,000, and commercial buildings, $150,000.

Of the $218,712,000, a total of $26,680,000 represented Canadian awards.

Coagulation basins, Cleveland, O., for Baldwin filtration plant, $1,439,000.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 333 to 348, are the following large projects:

Subway, New York, N. Y., to Patrick McGovern, $5,976,086.

Dock, Superior, Wis., to Pepard and Fulton, $1,000,000.

Labor Rates and Conditions Throughout the Country

The industrial situation is one of doubt. The key lies in the construction industry, where prices of materials and rates of labor have advanced to prohibitive levels. The reaction is a curtailment of new projects where urgency is not essential. The chief reason for high cost is that the building program outgrew the capacity of the industry, so far as labor and materials are concerned.

The "buyers' strike" seems to be confined principally to the New York district, where construction valued at $175,000,000 has been shelved. New York is also the only one of twenty cities reporting monthly to *Engineering News-Record* to show strike conditions in the building trades.

The bricklayers, now on strike, represent the key craft in the New York building trades, which in turn form the basis for similar trades throughout the country. The trouble, therefore, now developing in the key industry may, in a very short time, react unfavorably upon the entire business situation.

The common labor rate for the nation as applied to pick-and-shovel men in construction operations, is placed at 53c. per hr. as against 51c. for the preceding month, according to *Engineering News-Record's* figures. Local

CURRENT BUILDING TRADES WAGE RATES PER HOUR
(Higher rates indicated by +, decreases by—)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	+$0.90	$0.70	$0.30	.....	$0.65	$0.30@.35
Baltimore	1.50	1.00	.80@1.00	.87½	$0.65	.80@1.00	.30@.50
Birmingham	1.00	.75	.50@1.00	.15@.25	.....	1.00	.20@.30
Boston	1.25	1.05	1.00@1.25	.82½	.95	1.12½	.60@.70
Cincinnati	1.25	+1.05	+1.05	+.82½	+1.05	+1.05	.45
Chicago	+1.15	1.15	1.10	.....	1.10	1.05	+.85
Cleveland	1.40	1.25	1.25	.87½	1.00	1.25	.87½
Dallas	+1.50	1.00	1.00	.40	.87½	1.00	.30@.50
Denver	1.37½@1.50	1.12½	1.12½@1.18¾	.75@.81¼	1.00	1.15⅝	.35@.55
Detroit	1.12½	.80	.80@.90	.50@.60	1.00	.60@.80	.50
Kansas City	+1.37½	1.00	1.00@1.25	+.90	1.00	+1.07½	+.40@.70
Los Angeles	1.25	87½@1.00	87½@1.00	.62½	.....	1.00	.50
Minneapolis	+1.12½	+.87½	+.87½	+.71½	.....	+.87½	+.55
Montreal	+1.00	.65	.50	+.35	.50	.65	+.30
New Orleans	1.00	.85	.90	.65	.80	1.00	.35@.40
New York	1.50	+1.25	1.25@1.50	1.00	1.00	1.12½	.50@.75
Pittsburgh	1.30	1.20	1.12½	+1.00	.....	+1.25	+.60
St. Louis	1.50	1.25	1.25@1.37½	+1.25	1.00	1.25	.45@.90
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.12½	1.00	1.00	93¾	1.00	1.12½	.50@.62½
Philadelphia	1.37½	1.12½	1.00	.75@1.00	1.10	1.10	.50@.65

building conditions are as follows:

Atlanta—Some building being held up; general feeling of uncertainty in construction field. Carpenters advanced from 70c. to 90c. per hr.

Chicago — Landis Award Board granted carpenters advance from $1 to $1.15 per hr.; bricklayers, from $1.10 to $1.15; caisson workers, from 97½c. to $1.10 and common laborers, from 72½c. to 85c. per hr.

Kansas City—Shortage of bricklayers and carpenters, latter will demand advance of 12½c. per hr., July 1. Structural iron workers will demand increase of 17½c. per hr. Sept. 1.

New York—About 2,000 bricklayers on strike on jobs covered by the Mason Builders' Association. Over $150,000,000 of new construction work affected. Employers offer $10, with bonus of $2 per day, until Jan. 1, 1924. Unions demand $12 per day contract for two years. All bricklayers, however have found work on jobs not covered by the Mason Builders' Association.

Pittsburgh — Scarcity of carpenters and common laborers; enough of other trades. Labor shortage in steel mills probably reached lowest point, as those preferring outdoor employment in Summer have already left the mills.

St. Louis — An acute shortage of bricklayers; offering bonuses of $1 to $3 per day. Structural iron workers also granted a bonus of $1 per day.

Monthly Prices of Construction Materials

Ups and Downs of the Market

Pig Iron — Market quiet during month; Birmingham base still at $27 for No. 2 foundry. Southern No. 2 iron advanced 50c. in New York and $1 in Philadelphia; gray forge dropped $1.50 in Philadelphia and No. 2 foundry, $1 per ton in Pittsburgh, since last month.

Railway Supplies—Track bolts up 25c. per 100 lb. at Pittsburgh mill. All track supplies higher in San Francisco. No change in ties and rails.

Pipe—Birmingham mill base on cast-iron pipe unchanged since May 3, still $49 per ton on 6-in. and over. Chicago warehouse price up $2 per ton; slight rise in St. Louis. New York warehouse discounts on black wrought-steel pipe, reduced four to five points; galvanized, five to six points, following recent reduction on Pittsburgh basing card. Sewer pipe, 3 to 36-in., lower in Cincinnati and Atlanta; advanced somewhat in Los Angeles and Kansas City.

Road and Paving Materials—Road oils advanced slightly in St. Louis and Dallas, due to reported scarcity of Mexican crude. Asphalt also higher in Dallas and St. Louis but down in Kansas City and Los Angeles. Granite paving blocks up $3 per M. in Cincinnati and 30c. per sq.yd. in Kansas City. Wood block higher in New York and Boston but lower in Kansas City and St. Louis, due to reduction in cost of raw materials in the latter two cities.

Sand, Gravel and Crushed Stone—Gravel advanced 5c. in St. Louis and 10c. per cu.yd. in Minneapolis; declined in Detroit. Sand rose 25c. in both Cincinnati and Minneapolis; advanced slightly in Detroit and went up 5c. per cu.yd. in Dallas due to higher labor costs. Crushed stone, ¾-in., advanced 5c. in St. Louis and 1½-in., 15c. per ton in Cincinnati, during month.

Lime—Both lump and hydrated reported higher in St. Louis, Detroit, Kansas City, Cincinnati, Boston and Minneapolis. Los Angeles reports only decline, that of 25c. per bbl. in common lump.

Cement—Prices stable throughout country. Of thirty cities reporting monthly to *E. N.-R.*, all show no change except Kansas City and Denver. The former reports slight advance and the latter an equally slightly decline.

Structural Steel—Slight improvement in steel buying. Demand principally for tank plates and car material. Minimum on plates remains at $2.50 per 100 lb., Pittsburgh, with some contract tonnages quoted at $2.55@$2.60. Price trend in steel plates taking upward turn. Structurals also firmer; demand somewhat restricted owing to postponement of many new building projects. Bars firmer; buying still at $2.40@$2.50 per 100 lb. at mill.

Brick and Hollow Tile—Common brick up 50c. in Boston, $1.50 in New Orleans, $2 in Cincinnati and $1 per M. in St. Louis due to shortage. Prices dropped, however, 20c. in Dallas, $1 in Kansas City and $2 per M. in Baltimore, where yards have caught up with orders. Hollow tile higher in Cleveland, Atlanta, St. Louis and Detroit; down in Boston and Cincinnati.

Lumber—Pine rose $4.25 per M. ft. in Kansas City on 8-in., and $1.25 on 12-in. timbers, and $1 in Boston on 2-in. dimension lumber; declined 75c. in Detroit on 1-in. boards. Fir advanced $3.50 in Cincinnati on 8-in. timbers and 75c. on 2-in. dimension; dropped 50c. in Minneapolis on 1-in. boards and $1 on 2-in. dimension, also $1 per M. ft. in Denver on 12-in. structural timbers. General price level about the same in other cities, with some soft spots here and there.

Explosives—Forty per cent gelatin dynamite advanced slightly in Cincinnati and Atlanta; no other important changes.

Pine Piles—Price f.o.b. New York up 1½c. per lin.ft. by barge and 1c. by rail, during month. Advances due to wage increases at production points. Northern agents depleting labor supply in Southern cutting areas, to serious degree.

Scrap—Dealers' and producers' prices lower in New York and St. Louis.

Linseed Oil—New York price unchanged in month. Chicago up 12c. per gal. since May 3.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton—Quotations compiled by The Matthew Addy Co.:

	June 7	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25 @ 2.75)	$31.55	$25.52
Northern Basic	32.27	25.02
Southern Ohio No. 2 (silicon 1.75 @ 2.25)	33.27	22.50
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25 @ 2.75)	34.94	28.56
BIRMINGHAM		
No. 2 Foundry (silicon 2.25 @ 2.75)	27.00	17.50
PHILADELPHIA		
Eastern Pa., No. 2X, (2.25@2.75 sil.)	32.64	26.36
Virginia No. 2 (silicon 2.25 @ 2.75)	35.17	28.34
Basic	31.50	23.50@25.50
Gray Forge	*30.00*	25.00
CHICAGO		
No. 2 Foundry Local (silicon 1.75 @ 2.25)	33.00	23.50
No. 2 Foundry Southern (silicon 2.25 @ 2.75)	33.01	24.17
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley (silicon 1.75 @ 2.25)	*31.00*	24.16
Basic	31.00	25.00
Bessemer	31.00	26.96

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	June 7	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$40.00	.....	$43.00	$43.00
Standard openhearth rails	43.00	40.00	$43.00	43.00	43.00
Light rails, 8 to 10 lb	45.00	30@32	2.00*	43.00	43@45
Light rails, 12 to 14 lb	45.00	30@32	2.00*	43.00	43@45
Light rails, 25 to 45 lb	45.00	30@32	2.00*	43.00	43@45
Rerolled Rails	.....	28.00	.....	.....	.....

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, White Oak	$1.50	$1.65
Chicago, Hardwood and Red Oak	1.25	1.40
Chicago....Empty Cell Creosoting (add'l)	.45	.50
San Francisco..... Green Douglas Fir	.84	1.14
San Francisco, Empty Cell Creosoted. Douglas Fir	1.70	2.25
St. Louis, White Oak	1.30	1.55
St. Louis (creosoted) (zinc treated)	1.70	2.05
St. Louis, Red Oak, plain	1.20	1.45
St. Louis, Sap pine-cypress	1.05	1.30

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	June 7	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$3.15	$2.25	$3.00	$4.15	$5.00	$3.60
Track bolts	4.25@4.50	3.00@3.50	4.00	5.15	6.20	4.60
Standard section angle bars	2.75	2.40	2.75	4.00	4.25	3.00

PIPE

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62	50½	¼ to 1¼	30	13

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60	49½	¼ to 1¼	30	4
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	48%	50%	52%
2½ to 6 in. lap welded	44%	47%	49%
	Galvanized		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	34%	37%	39%
2½ to 6 in. lap welded	30%	34%	36%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 10%. Cast iron, standard sizes, 21½% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	Birmingham	New York				
	Mill	June 7	One Year Ago	Chicago	St. Louis	San Francisco
4 in.	$53.00	$66.50@67.50	$51.80	$64.20	$61.60	$64.00
6 in. and over	49.00	62.50@63.50	48.80@49.80	60.20	57.60	60.00

Gas pipe and Class "A," $5 per ton extra; 16-ft. lengths, $1 per ton.

CLAY DRAIN TILE—The following prices are per 1000 lin.ft.:

	New York					
Size, In.	June 7	One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$45.00	$40.00	$40.00	$62.50	.....	$73.00
4	55.00	50.00	40.00	75.00	$76.50	83.00
5	80.00	80.00	.....	100.00	97.75	108.00
6	105.00	100.00	75.00	175.00	127.50	133.00
8	170.00	150.00	*170.00*	187.50	212.50	199.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	.....	$0.114	.....	.....	$0.15	$0.12	.....
4	...	.114	$0.10	$0.10	.15	.15	$0.12
5	...	.171	.125	.....	.23	.18	.16
6	$0.24	.171	.150	.14	.23	.21	.185
8	.38	.266	.25	.225	.35	.30	.30
10	.57	.399	.325	.315	.53	.42	.441
12	.72	.513	.425	.405	.68	.54	.567
15	1.13†	.684	.625	.675†	.90	.90	.819
18	1.65†	.95	.85	.945†	1.25	1.32	1.071
20	1.98†	1.14	1.125	.....	1.50	.....	.....
22	2.64†	1.52	1.375	1.26†	2.00	.....	1.44
24	2.97†	1.71	1.625	1.62†	2.25	2.16	1.89
27	4.81†	2.99	....	2.65†	4.69†	3.00	3.34
30	5.33†	3.312	....	3.25†	5.94†	3.60	4.06
33	6.93†	4.41	....	3.95†	6.88†	.....	4.99
36	7.91†	5.0225	....	4.30†	7.50†	.....	5.42
	3	5	8	12	24		36
Boston	$0.127	$0.195	$0.308	$0.595	$1.975†		$5.90†‡
Minneapolis	.....	.....	.40	.72	2.55		5.66†
Denver	.135*	.18*	.27	.47	1.70		.....
Seattle	.13	.....	.36	.72†	2.60†		.....
Los Angeles	.13	.165	.275	.495	1.65		.....
New Orleans	.112*	.168*	.28	.476	1.182		.....
Cincinnati	*.12*	*.18*	*.28*	*.84*	*1.80*		*4.10†*
Atlanta	*.09**	*.15**	*.25*	*.425*	*1.62*		.....
Montreal, *delivered*	.68‡	.45†	.70	1.35	4.50†		.....
Detroit	.117	.1755	.273	.5265	2.34†		6.15†
Baltimore	.126	.189	.294	.567	1.89		5.4375
Kansas City, Mo	.15*	.21*	.33*	.40	*.60*		.....
Philadelphia	.124	.1871	.286	.545	1.89†		4.37†

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

		June 7	One Year Ago
New York, 45% asphalt	(at terminal)	$0.0525	$0.05
New York, 65% asphalt	(at terminal)	.0525	.045
New York, binder	(at terminal)	.06	.055
New York, flux	(at terminal)	.0575	.05
New York, liquid asphalt	(at terminal)	.06	.06
St. Louis, 50@60% asphalt		.0585	.05
St. Louis, 40@50% asphalt		.0535	.....
Chicago, 40–50% asphalt		.0525	.05
Chicago, 60–70% asphalt		.055	.0525
Dallas, 45% asphalt		.049	.10
Dallas, 55% asphalt		.0455	.13
Dallas, binder		.061	.15
San Francisco, binder, per ton		9.50*	13.00*

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Mexican*)	$19.00	$15.00
Boston (*Mexican*)	21.00	17.00
Chicago (*Stanolind*)	22.25	16.00
San Francisco, *f.o.b. refinery*, Oleum, Cal.	17.00*	11.00*
Dallas, (*Texas*)	27.10	21.10
Seattle, "*D*" *grade* (*California*)	24.75	20.50†
Denver (*California*)	24.00	....
Minneapolis *f.o.b. Twin Cities* (*Stanolind*)	25.45	19.10
St. Louis (*Mexican*)	32.50	27.50
Baltimore (*Standard Oil*)	21.00	15.00
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	26.00	23.50
Detroit (*Mexican*)	22.47	18.40
Cincinnati (*Kentucky Rock*)	22.50	19.50
Maurer, N. J. (*Bermudez*)	28.00	26.00
Maurer, N. J. (*Mexican*)	21.50	18.50
Philadelphia (*Mexican*)	21.00	18.00
Kansas City (*Texas*)	27.30	22.30
Los Angeles "*D*" *grade* (*California*)	17.00‡	11.00‡

*Freight to San Francisco, 80c. per ton.
†F.o.b. Richmond, Cal.
‡F.o.b. El Segundo refinery.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade 1)	5-in. granite, 30 blocks per sq.yd.	$134.50 per M.
Chicago	About 4x8x4 dressed	3.50 per sq.yd.
	About 4x8x4 common	3.10 per sq.yd.
San Francisco	Basalt block 4x7x8	70.00 per M.
Boston	5-in. granite, 28 blocks per sq.yd.	$130.00 per M.
Atlanta	Granite	2.66 per sq.yd.
Detroit	5-in. Granite	$106.00 per M.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	100.00 per M.
New Orleans	Granite, 4 x 8 x 4	3.25 per sq.yd.
Cincinnati	Granite	$138.00 per M.
St. Louis	4x8x4 dressed	3.10 per sq.yd.
	4x8x4 common	2.90 per sq.yd.
Kansas City	Granite	3.55 per sq.yd.
Philadelphia	Granite	134.50 per M.

FLAGGING—

New York	Bronx, 4 ft wide	$0.22 per sq.ft.
	Manhattan, 4 ft. wide	.22 per sq.ft.
	Queens, 5 ft. wide	.24 per sq.ft.
	6x24-in. cross-walk	1.10 per lin.ft.
Chicago	18 in. wide	.... per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5 x 16 in., 80c.; 5 x 20 in., Queens, 85c. *St. Louis*: Class "A" straight, delivered, 5 x 16 in., $1.40 per lin.ft. *Chicago*: 5 x 8 in., $1.65; 6 x 8 in., $1.95 per lin.ft. delivered.

WOOD BLOCK PAVING—	Size of Block	Treatment	Per Sq.Yd.
New York (*delivered*)	3	16	$2.69
New York (*delivered*)	3½	16	3.19
Boston	3½	18	2.65
Chicago	4	16	3.00@3.25
Chicago	3½	16	2.50
St. Louis	3½	16	2.60
St. Louis	4	16	2.95
Seattle	4	16	Off market
Minneapolis	3½	16	2.62
Atlanta	3½	16	2.00
New Orleans	3	16	2.45
New Orleans	3½	16	2.65
New Orleans	4	16	2.95
Dallas	4	18	3.90
Baltimore	3½	16	none used
Montreal	4	16	4.50
Detroit	3	16	2.84
Detroit	4	16	3.00
Cincinnati	3½	16	2.38
Kansas City	4	16	2.75
Philadelphia	4	18	....

CONSTRUCTION MATERIALS

SAND AND GRAVEL—Price for cargo or carload lots to contractor is as follows, per cu.yd.:

	Gravel 1½ In.		Gravel ¾ In.		Sand	
	June 7	One Year Ago	June 7	One Year Ago	June 7	One Year Ago
New York	$2.25	$1.75	$2.25	$1.75	$1.25	$1.00
Denver	1.90	2.50	1.90	2.50	1.00	1.10
Chicago	2.00	1.80	2.00	1.80	2.00	1.80
St. Louis	2.40†	1.25†	2.45	1.30†	2.10†	1.10†
Seattle	1.25	1.25	1.25	1.25	1.25	1.25
Dallas	2.25	2.25	2.25	2.25	1.95	2.25
Minneapolis	1.85*	1.50	2.10*	1.50	1.25	1.00*
Cincinnati	1.50†	1.87½	1.50†	1.87½	1.50†	1.43
San Francisco	2.15	2.25	2.15	2.25	1.50	1.50
Boston	1.50†	2.40	1.50†	2.40	1.20†	1.65
New Orleans	2.85	2.08½	2.85	2.08½	1.25	1.35
Los Angeles	0.75*	1.50†	0.85*	1.50†	1.10†	1.35†
Atlanta	1.90†	1.85†	1.90†	1.85†	1.24†	1.15†
Detroit	1.68	2.00	1.68	2.00	2.02½	2.00
Baltimore	1.86	1.40	2.06	1.60	0.80†	2.00
Montreal	1.25†	1.25†	1.50†	1.50†	1.25†	1.25†
Birmingham (Crushed slag used instead of gravel)					1.45†	1.25†
Philadelphia	1.85	1.50	1.95	1.55	1.90	1.60
Kansas City	1.60	2.00	1.60	2.00	0.66†*	1.20

New York—Grit, $1.75 per cu. yd.; ready mixed, $2.25
Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.
* At pit.
† Per ton.

CRUSHED STONE—Price for cargo or carload lots f.o.b. city, unless stated otherwise, is as follows, per cu.yd.:

	1½ In. June 7	1½ In. One Year Ago	¾ In. June 7	¾ In. One Year Ago
New York	$1.65	$1.65	$1.75	$1.75
Chicago	2.00	1.60	2.00	1.60
St. Louis *delivered*	2.10	1.65	2.35	1.65
Dallas	2.50	2.73	2.50	2.73
San Francisco	2.15	2.25	2.15	2.25
Boston, *delivered*	1.75*	3.00*	1.75*	3.00*
Minneapolis, *at plant*	2.00	2.00	2.25	2.25
Kansas City	1.50	2.10	1.50	2.10
Denver	3.50	3.50	3.50	3.50
Seattle *delivered*	3.00	3.00	3.00	3.00
Atlanta	2.00*	1.90*	2.00*	1.90*
Cincinnati	1.90*	1.75	1.90*	1.75
Los Angeles	1.60	1.75*	1.60	1.85*
Detroit	1.75	1.90*	1.75	1.90*
Baltimore	2.50	1.75*	2.55	1.65*
Montreal	1.80*	2.00*	1.90*	1.60*
Birmingham *delivered*	3.20	3.20	3.10	3.10
Phildelphia	1.80*	1.70*	1.65*	1.55*
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	3.25*	3.00*	3.25*	3.00*

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plants:

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Steubenville District	1.40	1.40	2.00	1.40
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa	0.85	0.90	2.50	....
Birmingham, Ala	1.05	1.15	2.05	0.80
Buffalo, N. Y., and Erie, Pa	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.45	1.45	1.45	1.25
Eastern Pa. and Northern N. J	1.20	1.20	2.50	1.20
Western Pennsylvania	1.25	1.25	2.00	1.25
Longdale and Glen Wilton, Va	1.25	1.25	2.50	1.00
Toledo, Ohio	1.50	1.50	1.50	1.50

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$18.20	$13.10	$3.75*	$3.00@3.25*
Chicago	20.00	20.00	1.50†	1.50†
St. Louis	23.20	20.00	3.75*	3.00*
Boston	22.00	15.00	4.25*	2.50*
Dallas	22.50	....	....	2.50†
Cincinnati	16.80	13.40	....	....
San Francisco	22.00	16.00	....	1.75†
Minneapolis	25.50	21.00 (white)	1.70†	1.50†
Denver	24.00	....	....	2.70†
Detroit	21.00	20.00	....	20.00‡
Seattle *paper sacks*	24.00	.....	2.80†	....
Los Angeles	....	.....	....	2.75*
Baltimore	24.25	17.25	2.55	....
Montreal	21.00	21.00	....	11.00‡
Atlanta	23.50	15.00	2.35†	1.50†
New Orleans	....	.....	2.40†	....
Philadelphia	16.00	15.00	13.50‡	12.50‡
Kansas City	28.00	24.00	3.12*	2.96*

*Per 280-lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton—Refund of 10c. per bbl. Minneapolis quotes brown common lump lime; Kelly Is. white is $1.70, Sheboygan $1.60. New York quotes hydrated lime "on cars" in paper sacks; lump lime "alongside dealers docks" or "on cars."

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, f.o.b., exclusive of bags:

	June 7	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.50	1.60
Atlanta (Magnolia)	11.00 per ton	11.00 per ton
Cincinnati (Utica)	1.72	1.77
Boston (Rosendale)	2.60	0.80 per bag
St. Louis (Carney)	2.85	2.10

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	June 7	One Month Ago	One Year Ago
New York, del. by truck	$2.70@2.80	$2.70@2.80	$2.40@2.50
New York, alongside dock to dealers	2.30	2.30	2.10
Jersey City	2.48	2.48	2.32
Boston	2.80	2.80	2.50
Chicago	2.20	2.20	2.07
Pittsburgh	2.24	2.24	2.12
Cleveland	2.46	2.46	2.36
Detroit	2.48	2.47	2.37
Indianapolis	2.41	2.41	2.31
Toledo	2.48	2.48	2.39
Milwaukee	2.37	2.37	2.26
Duluth	2.14	2.14	2.04
Peoria	2.41	2.41	2.18
Cedar Rapids	2.48	2.48	2.31
Davenport	2.43	2.43	2.24
St. Louis	2.35	2.35	2.21
San Francisco	2.71	2.71	2.83
New Orleans	3.30	3.30	3.00
Minneapolis	2.39	2.39	2.34
Denver	2.84	2.85	2.90
Seattle	2.90	2.90	2.94
Dallas	2.25	2.25	2.25
Atlanta	2.85	2.85	2.34
Cincinnati	2.54	2.54	2.45
Los Angeles	3.20	3.40	3.30
Baltimore	2.65	2.65	2.50
Birmingham	2.50	2.50	2.27
Kansas City	2.45	2.42	2.40
Montreal	2.25	2.25	2.50
Philadelphia	2.41	2.41	2.21
St. Paul	2.39	2.39	2.34

NOTE—Bags 10c. each 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind.	$1.95	Hudson, N. Y.	2.20
Universal, Pa.	2.00	Leeds, Ala.	2.20
Steelton, Minn.	1.95	Bannibal, Mo.	2.10
Fordwick, Va.	2.20	Lehigh Valley District	2.10
Mitchell, Ind.	2.10	Wyandotte, Mich.	2.30
Iola, Kan.	2.10	Alpena, Mich.	2.10
Mason City, Ia.	2.10	Richard City, Tenn.	2.20
La Salle, Ill.	$2.10	Kingsport, Tenn.	2.20

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Warehouse: Pittsburgh Mill	Chicago Mill	New York	St. Louis	Dallas	San Francisco
032	22	**$0.95**	**$1.02**	$1.24	**$1.04**	**$1.12**	**$1.18**
049	28	**1.20**	**1.30**	1.58	**1.32**	**1.38**	**1.47**
068	35	**1.47**	**1.59**	1.94	**1.62**	**1.67**	**1.81**
093	45	**1.89**	**2.04**	2.50	**2.08**	**2.00**	**2.12**
126	57	**2.34**	**2.53**	3.09	**2.59**	**2.55**	**2.88**
153	68	**2.79**	**3.02**	3.60	**3.08**	**3.15**	.....
180	78	**3.20**	**3.47**	4.22	**3.54**	**3.47**	.....
245	103	**4.22**	**4.57**	5.60	**4.66**	**4.58**	.....
287	119	**4.88**	**5.28**	6.44	**5.39**	**5.26**	**6.00**
336	138	**5.66**	**6.13**	7.39	**6.25**	**6.11**	.....
395	160	**6.56**	**7.10**	8.67	**7.25**	**7.12**	.....
		PAVING					
036P	17	**$0.72**	**$0.78**	$0.95	**$0.79**	**$0.76**	.....
053P	24	**1.02**	**1.10**	1.35	**1.12**	**1.07**	.....
072P	31	**1.29**	**1.40**	1.71	**1.42**	**1.39**	.....
097P	40	**1.66**	**1.80**	2.20	**1.83**	**1.98**	.....
049R	24	....	**1.10**	....	**1.12**	**1.07**	.....
067R	31	....	**1.40**	....	**1.42**	**1.39**	.....
089R	40	....	**1.80**	....	**1.83**	**1.90**	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq. ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted are as follows:

Gage	Weight	*New York	Chicago	St. Louis	San Francisco	Dallas
27Dia.	2.3	**$22.00**	$21.25	**$20.72**	$21.43	$25.50
26 "	2.5	22.00	22.50	22.39	20.78	27.58
25 "	3.0	22.00	25.25	24.93	.....	30.71
24 "	3.4	24.00	27.25	27.10	**24.88**	33.16
22 "	4.33	27.00	31.75	32.27	.....	35.10

* Price to contractors at warehouse or delivered on job in Manhattan, Bronx or Brooklyn.

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Warehouse, Uncut: Pittsburgh Mill	Birmingham Mill	New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger..	**$2.40@2.50**	$2.65	$3.54	**$3.32½**	**$3.35**	**$3.70**	**$3.65**
⅝	2.45@2.55	2.75	3.59	3.37½	3.40	**3.75**	**3.70**
¾	2.50@2.60	2.85	3.64	3.42½	3.45	**3.80**	**3.75**
⅞	2.65@2.75	2.90	3.69	3.57½	3.60	**3.95**	**3.90**
1	2.90@3.10	2.95	4.04	3.82½	3.80	**4.20**	**4.15**

Includes 15c charge for cutting to lengths of 2 ft. and over.
Twisted bars cut to length take extra of 27½c. per 100 lb.

ROLLED FROM RAILS

	Chicago	St. Louis	Dallas		Chicago	St. Louis	Dallas
½ and larger	**$2.30**	**$3.05**	**$3.40**	½	$2.55	$3.30	**$3.65**
⅝ in.	2.35	3.10	**3.45**	¾	2.80	3.50	**3.90**
1	2.40	3.15	**3.50**	.....	.....	.....	.....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: June 7	One Month Ago	One Year Ago	Paving Block: 3-inch*	4-inch*
New York (del.)	$23.50	$23.50	$23.50	$46.50	$54.00
New York (at dock)	20.00	20.00	20.00	.....	.....
Chicago	**11.00**	11.00	11.00	34.00	42.00
St. Louis, salmon	**16@18**	**15@17**	14.00	**38@40**	**41.50@44.50**
Denver, salmon	12.00	12.00	12.00	.....	.....
Dallas	*12.90*	13.10	11.15	33.00	.....
San Francisco	15.00	15.00	15.00	.....	.....
Los Angeles (del.)	15.00	15.00	15.00	(not used)	
Boston	**22.50**	22.00	16.00	48.25	56.00
Minneapolis (del.)	17@19	17@19	16@17	.....	.....
Kansas City	*14.50*	15.50	14.50	.....	.....
Seattle	13.00	13.00	14.00	50.00	.....
Cincinnati	**20.00**	18.00	15.00	**45.00**	**55.00**
Montreal	16.50	16.50	16.00	100.00‡	68.00
Detroit (del.)	19.50	17.50@20.00	16.50	38.50	41.50
Baltimore (del.)	*21.00*	23.00	20.00	40.00	45.00
Atlanta	14.00	14.00	10.00	*40.00*	45.00
New Orleans	**18.75**	17.25	12.50	.....	.....
Birmingham	12.50	12.50	11.50	.....	.....
Philadelphia	19@25	19@25	16.50@17.50	40.00	48.00
Pittsburgh (del.)	16.00	16.00	16.00	.....	.....
Cleveland	16.00	16.00	.....	.....	.....

* For paving blocks 3½x8½x3 and 3½x8½x4 respectively. † F.o.b. ‡Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: June 7 on Trucks*	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory*
4x12x12	$0.1573	$0.1112	$0.0825	$0.125	**$.092**	**$0.108**	.....
6x12x12	.2097	.1667	.1135	.....	**.126**	.156	.....
8x12x12	.2621	.2084	.1547	.19	**.170**	.244	$0.2691
10x12x12	.....	.....	.1916	.....	.190	.....	.3505
12x12x12	.....	.....	.2190	.....	.236	.....	.4206

* 5 per. off for cash.

	4x12x12	8x12x12	12x12x12
Boston	*$0.11*	*$0.21*	.....
Minneapolis (f.o.b. cars)	.0736	.12125	$0.214
Minneapolis (delivered)	.0836	.1369	.239
Cincinnati	*.055*	.07	.....
Kansas City	.083	.1455	.....
Denver	.065	.123	.188
Seattle (delivered)	.11	.25	.36
Los Angeles factory	.10	.175	.....
New Orleans	.12	.23	.....
Detroit (delivered)	**.1145**	**.2147**	.27
Montreal	.115	.225	.30
Baltimore	.125	.27	.....
Atlanta	**.109**	**.1832**	.....
Dallas	.115	.....	.....
Birmingham	.11	**.18**	.....
Pittsburgh (delivered)	.068	.128	**.179**
Cleveland	.09	**.187**	.....

San Francisco, Philadelphia, Chicago and New York quote on hollow partition tile.

STRUCTURAL MATERIAL—Following are base prices f. o. b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh Mill	Birmingham Mill	Warehouse: New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	**$2.50@2.60**	**$2.75**	**$3.64**	**$4.50**	**$3.45**	**$3.40**	**$3.95**
Channels, 3 to 15 in.	2.50@*2.60*	2.75	3.64	4.50	3.45	3.40	3.95
Angles, 3 to 16 in., ¼ in. thick	2.50@*2.60*	2.75	3.64	4.50	3.45	3.40	3.95
Tees, 3 in. and larger	2.50@*2.60*	2.75	3.64	4.50	3.45	3.40	3.95
Plates, ¼ in. thick and heavier	2.50@*2.60*	2.75	3.64	4.60	3.45	3.40	3.95

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	New York: June 7	New York: One Yr. Ago	Warehouse: Chicago	St. Louis	San Francisco	Dallas
½ in. and larger	$3.25@3.50	**$4.40**	$3.50	$3.75	$4.15	$5.00	*$4.90*

CONE HEAD BOILER

½ in. and larger	$3.35@3.60	**$4.50**	$3.60	$3.85	$4.25	$5.10	*$5.00*
⅝ and ¾	3.50@3.75	**4.65**	3.76	4.00	4.40	5.25	*5.15*
⅞ and 1	3.75@4.00	**4.90**	4.00	4.25	4.50	5.50	*5.40*

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	**$3.00**	$3.45	**$4.30**	$4.25	**$3.44**	$4.95
Cut	...	5.50	5.80	5.75	3.74	5.00

PREPARED ROOFINGS—Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.50 per roll in less than carload lots f.o.b. Philadelphia.

Single shingles, red and green slate finish, cost $5.75 per square (sufficient to cover 100 sq.ft.) in less than carload lots, f.o.b. Philadelphia. Strip shingles (4 in 1) f.o.b. Philadelphia, l.c.l., *$6.20*.

ROOFING MATERIALS—Prices f.o.b. New York, in less than carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$67.50
Tar pitch (in 400-lb. bbl.), per 100 lb	1.62½
Asphalt roofing (in barrels), per ton, f.o.b. plant*	38.75
Asphalt felt (light), per ton, f.o.b. plant*	75.00
Asphalt felt (heavy), per ton, f.o.b. plant*	75.00

* Delivered in Metropolitan Dist., $3.00 additional.

WINDOW GLASS—Double strength, box list, united inches, 34, "AA" and "A" grades, at discount of 84 per cent from standard lists, f.o.b. New York; "B" grade less 85 per cent.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	**$3.00@3.25**	**$4.25**	**$4.15**	**$5.10**	**$4.89**
No. 12	**3.10@3.35**	4.30	4.20	**5.15**	**4.64**
No. 14	**3.20@3.45**	**4.35**	**4.25**	**5.20**	**4.69**
No. 16	**3.40@3.65**	**4.45**	**4.35**	**5.25**	**4.79**
Black					
*Nos. 18 and 20	**3.70@3.85**	**4.80**	**4.85**	**5.95**	**4.95**
*Nos. 22 and 24	**3.75@3.90**	**4.85**	**4.85**	**6.00**	**5.00**
*No. 26	**3.80@3.95**	**4.90**	**4.90**	**6.05**	**5.05**
*No. 28	**3.85@4.00**	**5.00**	**5.00**	**6.15**	**5.15**
Galvanized					
No. 10	4.00@*4.25*	**5.10**	**5.10**	**6.00**	**5.15**
No. 12	4.10@*4.35*	**5.20**	**5.20**	**6.10**	**5.25**
No. 14	4.10@*4.35*	**5.20**	**5.20**	**6.10**	**5.25**
Nos. 17 to 21	4.40@*4.65*	**5.50**	.....	**6.40**	**5.55**
Nos. 22 and 24	4.55@*4.80*	**5.65**	**5.65**	**6.55**	**5.70**
*Nos. 25 and 26	4.70@*4.95*	**5.80**	**5.80**	**6.70**	**5.85**
*No. 28	5.00@*5.25*	**6.10**	**6.10**	**7.00**	**6.15**

*For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: June 7	New York: One Year Ago	Chicago: June 7	Chicago: One Year Ago
Raw in barrels (5 bbl. lots)	$1.16	$0.91	**$1.37**	**$1.03**

WHITE AND RED LEAD—Base price in cents per pound:

	Red				White	
	June 7		1 Year Ago		June 7	Yr. Ago
	Dry	In Oil	Dry	In Oil	Dry or In Oil	Dry or In Oil
100-lb. keg	14.50	16.00	12.25	13.75	14.50	12.25
25 and 50-lb. kegs	14.75	16.25	12.50	14.00	14.75	12.50
12½-lb. keg	15.00	16.50	12.75	14.25	15.00	12.75
5-lb. cans	17.50	19.00	15.25	16.75	17.50	15.25
1-lb. cans	19.50	21.00	17.25	18.75	19.50	17.25

LUMBER

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M ft. additional.

	6–8 and 12 Ft.	10–16–18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$40.00	$41.00	$42.00	$45.00
3x6 and 8	40.00	41.00	42.00	45.00
4x4-6 and 8	40.00	41.00	42.00	45.00
3x10 and 12	40.00	41.00	42.00	45.00
3x14	42.00	42.00	44.00	46.00
4x10 and 12	40.00	41.00	42.00	45.00
4x14	42.00	40.00	44.00	46.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	$42.00	$44.00	$46.00
6x14	47.00	49.00	51.00
8x10	42.00	44.00	46.00
8x14	47.00	49.00	51.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York*		Chicago	
	20 Ft. and Under	22–24 Ft.	20 Ft. and Under	22–24 Ft.
3x 4 to 8x8	$52.00	$53.00	*$52.50*	*$54.50*
3x10 to 10x10	56.00	57.00	*55.50*	*57.50*
3x12 to 12x12	60.00	61.00	*58.50*	*60.50*
3x14 to 14x14	67.00	68.00	*63.50*	*65.50*
3x16 to 16x16	72.00	73.00	*68.50*	*70.50*
3x18 to 18x18	86.00	87.00	*80.50*	*81.50*
4x20 to 20x20	96.00	97.00	*91.50*	*93.50*

*Wholesale price to dealers to contractors, delivered from lighters or cars to job, $5 additional. Short leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12 x 12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under.

Other Cities

	8 x 8-In. x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	P.	Fir	Hemlock	Spruce	P.	Fir
Boston	$65.00	$130.00	*$60.00*	*$60.00*	$85.00	$150.00
Seattle		31.00	.....	.....	.....	31.00
New Orleans	35.00	.....	.....	.....	40.00	.....
Baltimore	35.00	53.00	53.00	60.00	50.00	53.00
Cincinnati	*42.00*	**55.00**	.....	.....	**50.00**	.....
Montreal	50.00	.....	.....	.....	90.00	90.00
Los Angeles	.....	53.00	.....	.....	.....	54.00
Denver	.....	43.00	43.00	43.00	.....	*43.00*
Minneapolis	46.50	*43.25*	41.50	.....	50.00	**47.75**
Atlanta	38.00	.....	.....	.....	42.00	.....
Dallas	48.00	.....	.....	.....	53.00	.....
Kansas City	**50.00**	**46.50**	**46.50**	.....	**60.00**	*48.50*
Birmingham	38.00	.....	.....	.....	45.00	.....
Philadelphia	47.00	41.50	40.00	45.00	58.00	42.00
Detroit	48.75	53.25	.....	.....	61.75	53.25
St. Louis	**46.50**	.....	.....	.....	**55.00**	.....

	1-In. Rough, 10 In. and Under x 16 Ft.			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir	Hemlock	P.	Fir
Boston	$50.00	$90.00	$50.00	**$58.00**	$105.00
Seattle	.....	28.00	.....	.....	30.00
New Orleans, at mill	80.00	.....	.....	39.00	.....
Baltimore	65.00	44.00	44.00	37.00	50.00
Cincinnati	**75.00**	**120.00**	**120.00**	**40.00**	*40.00*
Montreal	.....	50.00	37.00	45.00	45.00
Los Angeles	.....	48.00	.....	.....	.....
Denver	.....	37.25	*37.25*	.....	.....
Minneapolis	47.50	*42.75*	39.50	43.75	*40.25*
Atlanta	22.00	.....	.....	32.00	.....
Dallas	48.00	.....	.....	51.50	.....
Kansas City	*48.50*	43.50	.....	*44.00*	45.50
Birmingham	32.00	.....	.....	42.00	.....
Philadelphia	37.00	43.00	40.00	57.00	41.50
Detroit	*54.50*	42.00	.....	48.50	**43.75**
St. Louis	*44.00*	.....	.....	*34.00*	.....

Birmingham—Quotes carload lots, f.o.b. sidings. $1.50 additional per M. ft. to contractors.

Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.

Denver—Quotes dealers price to contractors on large projects.

St. Louis—Wholesale price to contractors, f.o.b. cars, $3 per M. ft. additional.

Seattle—Price to contractors, delivered.

Dallas—Wholesale to contractors, $10 per M. ft. additional.

FREIGHT RATES

On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.31	Detroit	$0.29
Birmingham	.69	Kansas City	.735
Boston	.365	New Orleans	.515
Buffalo	.26	New York	.34
Chicago	.34	Pacific Coast (all rail)	1.34†
Cincinnati	.29	Philadelphia	.32
Cleveland	.21	St. Louis	.43
Denver	1.27*	St. Paul	.60

*** Minimum carload, 40,000 lb.**

† Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.

CONTRACTORS' SUPPLIES

STEEL SHEETPILING—The following price is base per 100 lb. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

June 7	One Month Ago	One Year Ago
$2.65@2.75	$2.60@2.75	$2.00

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Hercules red strand, all constructions	20%
Patent flattened strand, special steel wire rope	20%
Patent flattened strand, iron rope	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington Discount 5 points less than discount for Eastern territory.

Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.

Arizona: Discount 10 points less than discount for Eastern territory.

Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.

North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¼-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ⅛-in., 8 ft., ¼-in., 6; ⅜-in., 4½; ½-in., 3½; ⅝-in., 2 ft. 10 in.; ¾-in., 2 ft. 4 in. Following is price per pound for ¼-in. and larger, in 1200-ft. coils:

Boston	*$0.15½*	New Orleans	$0.18½
New York	.18½	Los Angeles	.18
Chicago	.18	Seattle	.18
Minneapolis	.20½	St. Louis	.17½
San Francisco	.18	Montreal	.30
Atlanta	*.21*	Detroit	.19
Denver	.22	Baltimore	.18
Cincinnati	**.21**	Kansas City	.21½
Dallas	.129	Birmingham	.20½
Philadelphia	.18		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.275	$0.30
Boston	.23	.25
Kansas City	**.2275**	*.2375*
Seattle	.165	.195
Chicago	.22	.25
Minneapolis	.1967	.2173
St. Louis	.2275	.2525
Denver	.2075	.2325
Dallas	.29	.375
Los Angeles	.17	.20
Atlanta	**.235**	.26
Baltimore	.22	.23
Cincinnati	**.225**	.25
Montreal	.195	.235
Birmingham, *delivered*	.16	.17
New Orleans	.252	.285
San Francisco	.1625	.1925
Philadelphia	.2625	.295

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

SCRAP—The prices following are per gross ton paid to dealers and producers f.o.b. New York. In Chicago and St. Louis the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.

	New York	Chicago	St. Louis
No. 1 railroad wrought	*$17.00*	$11.50	*$16.00*
Stove plate	*14.00*	12.00	*15.00*
No. 1 machinery cast	*20.00*	16.50	*20.00*
Machine shop turnings	*13.00*	4.00	*12.00*
Cast borings	*14.00*	5.50	*13.00*
Railroad malleable cast	*15.00*	12.50	*20.00*
Re-rolling rails	*15.00*	13.00	*19.00*
Relaying rails	.....	30.00	*28.50@30.50*
Heavy melting steel	*14.00*	.....	.....

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco Galv.	San Francisco Black	Seattle Black
½	**$9.85**	**$7.65**	**$8.00**
⅝	**7.80**	**6.30**	7.75
¾	**7.75**	**6.15**	7.70

Pittsburgh base in lots of 200 kegs or more, $3.50@3.75.